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Feeding the modern way

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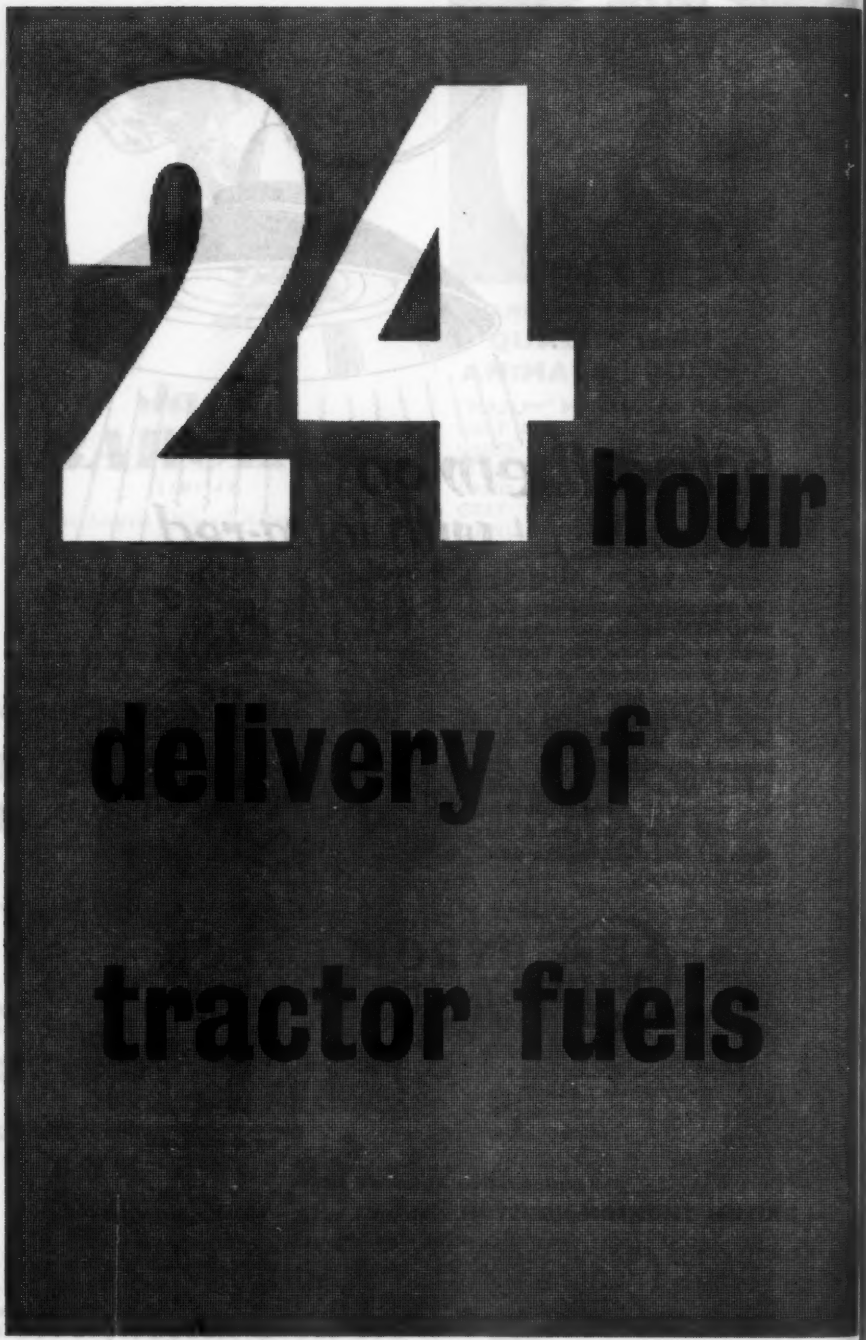
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A new concept in Veterinary Pharmacology

Iodine has been employed for many years for disinfecting the skin and it is in many ways an ideal antiseptic, but hitherto its use and that of various formulations have been limited by certain factors intrinsic in its nature, for example, the irritation and pain produced on application, and the corrosive and staining properties of preparations containing elemental iodine.

Dermevan has none of the undesirable qualities of earlier preparations. It is an entirely new concept in topical iodine therapy, being a complex of iodine with a non-ionic surface active agent which, solubilising the iodine, allows immediate effectiveness on application. Very briefly, this new formulation of iodine makes elemental iodine available for bactericidal, fungicidal and virucidal action in such a manner that less than 20% of the iodine is present as organically bound iodine, over 80% of the iodine being "available".

Dermevan is non-toxic, it is non-irritating and painless and does not permanently stain. It is odourless and can be stored indefinitely without risk of precipitation or deterioration.

Clinical Applications of Dermevan

The wide range of bactericidal action of Dermevan and its fungicidal and virucidal properties permit its use in a variety of veterinary procedures in both large and small animal veterinary practice.

It is effective in the treatment of footrot in sheep, the contents of one 500 ml. bottle being sufficient to treat up to 150 affected feet.

As a specific medicament for the treatment of ringworm, Dermevan is effective and is painless on application.

Dermevan meets the need for a general and efficient antiseptic for the treatment of the numerous conditions of indeterminate dermatitis, including otitis externa and anal adenitis in cats and dogs. There is little risk of the development of allergic reactions following skin sensitisation after applications of Dermevan.

In the achievement of asepsis Dermevan has a wide variety of uses:—for the pre-surgical preparation of the skin surface, for the treatment of skin wounds, and for the routine sterilization of teats as an udder wash. As an antiseptic for use at parturition and whenever post-natal treatment of an animal is necessary, Dermevan may be used at a dilution of 1/100 or at higher strengths as required. No pain or irritation is caused and no undesirable tissue reactions follow its use.

In addition to its applications in the topical treatment of animals, Dermevan provides an ideal biocidal agent for the general disinfection of thermometers, theatre equipment, floors, animal cages, etc. Dermevan is effective on dilution as long as colour is perceptible.

In the surgery, between the treatment of cases, diluted Dermevan may be used as a hand wash. It is non-irritant and any colouration is easily removed with ordinary tap water when the operations have been completed. One feature of Dermevan which will be of interest to veterinary surgeons continually using antiseptics in one form or another, and who are prone to sensitisation, is that Dermevan will not cause uncomfortable skin reactions on the hands or forearms.

Dilutions of Dermevan

It is advised that Dermevan is used undiluted in the direct treatment of footrot infection and ringworm lesions. For achieving skin asepsis as a preliminary to surgical operations and for many other uses, dilution is permissible.

A useful guiding rule is that when Dermevan is to be used for direct treatment of an animal, being applied with a brush or swab, it should be used undiluted. In baths or washes, or for use as a general purpose antiseptic, a dilution of 1/100 gives satisfactory results. At much higher dilutions, although the biocidal qualities of iodine are retained the physical properties of the undiluted complex—penetrative power, detergent effect—deteriorate and approach those of a simple aqueous solution of iodine.

Advantages of Dermevan

Briefly, the advantages of Dermevan may be summarised as follows:—

1. Maximum utilisation is made of the bactericidal efficiency of iodine.
2. Activity is maintained over a wide range of the bacterial spectrum.
3. Also effective against viruses, protozoa and moulds.
4. Action is immediate.
5. Reduction of activity in the presence of organic matter is less with Dermevan than with quaternary ammonium compounds or hypochlorites.
6. Low toxicity and much lesser tendency to produce sensitisation than other types of iodine solution.
7. Does not cause pain on application to open wounds.
8. Negligible loss of activity from evaporation or storage.
9. Does not permanently stain, but the colouration provides a useful built-in indicator of activity.

Presentation

Dermevan is supplied in amber glass bottles of 500 ml.

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viii

Agriculture

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CONTENTS

Cover Photograph: Feeding the modern way *Photo: Shell-Mex and B.P. Ltd.*

Pasture Rearing Bucket-fed Calves

D. T. CHAMBERS, B.SC., F. E. ALDER, D.F.C., B.SC.(OXON), M.A.
and
WILLIAM DAVIES, D.SC.
Grassland Research Institute, Hurley, Berkshire

Calves reared out of doors at Hurley have been healthier than those kept in a good calf-house. They gained at least 1¼ lb live weight a day, and suffered no check at weaning.

SUCCESSFUL calf rearing is of prime importance to the farmer who keeps livestock: the future productivity of his cattle depends upon it, and costs largely determine his profits. Research workers have also shared the interest, and more work has probably been devoted to the various aspects of rearing than to any comparable subject. Work in the United Kingdom and America has tended to reduce the volume of whole milk offered to young calves. Relatively inexpensive milk substitutes have been devised, and attention has been given to early rumen development and the ingestion of solid food. This so-called early-weaning system is successful, but has been criticized by farmers because it involves the heavy feeding of expensive concentrate feeds. When cattle are expected to produce meat or milk from a diet in which grass is playing an ever-increasing role, it is questionable whether the feeding of large quantities of concentrates to young stock is either desirable or economic.

For some years now, New Zealand farmers have used an inexpensive but successful system of rearing.* Their calves are given access to grass soon after birth, and fresh skim milk quickly replaces whole milk in the diet. Conditions in that country may be less testing than in our own, but it was to study the possibilities and problems of pasture rearing that work was started on the subject at Hurley several years ago. This work has involved the use of nearly 150 calves, of which over 30 per cent have been reared outdoors.

Hardiness tested at Hurley

Unless the calf can withstand the rigours of the climate, all ideas of rearing at pasture must be abandoned, no matter how valuable grass may be as a food. The majority of hill cattle are born in the open, often during very bad weather. Such calves have only limited shelter from their dams, who are occupied with grazing for eight to ten hours each day. They have the benefit, however, of an adequate supply of milk. To test the hardiness of bucket-fed animals under more severe feeding conditions, groups of bought-in Hereford-cross calves (out of several dairy breeds) have been put out to pasture at ten to fourteen days old. This has taken place during the last few days of February or the first week of March over the past three years. In 1957 the site chosen was some 200 feet up, on an exposed north face of an outcrop of

* Good Rearing of Dairy Stock. C. P. MCMEEKAN. *N.Z.J. Agric.*, 1954, **88**, 306–20, 481–5, 593–7.

the Chilterns. In March 1958 the calves were put out a few minutes before a heavy fall of snow! In the first year the only shelter provided was a few straw bales, while in the second year a galvanized iron pig hut was used.

Besides the grazing, each calf had a daily ration of 1½ lb milk substitute powder or dried buttermilk powder, mixed in 8–12 pints of warm water. To this "milk" ration we added a small vitamin supplement, to replace the vitamins A and D removed with the butter fat. It is doubtful, however, if calves kept outdoors on green food require additional sources of vitamins A and D. Each calf also had a dose of 300 mg aureomycin on arrival at the farm; there appeared to be no benefit from feeding a daily supplement of antibiotics. No concentrates and no hay were given.

Autumn-born calves have also been reared at pasture. In 1956 they had a galvanized iron hut for shelter, but in 1957 calves born in early October were placed on pasture with no shelter whatsoever. These animals remained outdoors throughout the winter and have never been under cover. They were offered 1–2 lb of hay when the weather was bad, and this was increased when snow covered the ground. Silage and oats were fed when the supply of foggage was exhausted, after weaning.

In general, the health of these calves reared outdoors has been excellent. Out of fifty-five calves reared at pasture, five have been lost. One, and probably a second, died as a result of consuming excessive quantities of a mineral mixture which was on offer for a short time. Two died from bloat; this condition also occurred in animals reared indoors, and appears to have been caused by a too rapid ingestion of milk from an open pail. The use of a teat-suckling device seems to have overcome this difficulty. Only one calf died from scours and slight congestion of the lungs, and it is almost certain that it was already infected when bought.

After such severe tests there can be little doubt about the hardiness of these calves. Not only have those animals reared outdoors at Hurley been healthier than those kept in a good calf-house, but feeding trials have shown that they will start to eat solid food earlier and in greater quantities. These colour-marked Hereford steer calves put on at least 1½ lb live weight per day throughout the twelve-week rearing period, and suffer no check at weaning.

Readiness for early grazing

Bucket-fed calves normally eat little or no hay or concentrates during the first three weeks unless their ration of milk is severely restricted. Similarly, observations have shown that single-suckled calves at pasture with their dams are not inclined to seek food other than milk for about six weeks after birth. Calves reared on the bucket will, however, readily start to graze when turned out, and will spend two, or even three, hours a day grazing after having been at grass only two days. This time increases rapidly, and a twelve-week-old calf will graze for as long as ten hours a day if necessary.

Trials in which the progress of calves reared at pasture has been compared with that of calves reared on multiple-suckling and bucket-feeding systems indoors have shown that grass is a valuable food for young calves. Where the milk ration has been similar, grass has produced greater daily liveweight gains than concentrates and high-quality hay fed *ad lib*.

One interesting result which has arisen during the work at Hurley is that

the feeding of concentrates may not only be wasteful but may retard the progress of the calf in some cases. It was found that calves offered ground oats in addition to milk and autumn pasture made lower liveweight gains than those offered a high protein meal or no concentrate supplement at all. With their limited capacity for dry matter, calves consuming 2–3 lb of oats each day were probably unable to take in sufficient herbage to meet their protein requirements. It was noticed that all calves receiving a supplement of concentrates grazed for a shorter period than those feeding on milk and grass.

The calf can make excellent use of high-quality grass. Calves are selective grazers, and New Zealand work has shown the importance of providing them with an ample supply of good grass.

The parasite question and grazing management

It has long been known that calves are highly susceptible to internal parasites. Unfortunately, this elementary fact has often been disregarded in previous work on pasture rearing in this country. The idea that good feeding can prevent an outbreak of husk or of worms is dangerous. Animals of any age that have not previously been infected by parasites, are liable to suffer fatal infections when grazing on even the leafiest of swards if it is heavily infested with parasitic larvae.

For this reason, calves reared at Hurley are put on either new leys or swards that have not been grazed by *cattle* for about twelve months or by sheep for three months. A point is also made of rotational grazing, for not only does this provide better quality herbage, but it prevents a serious build-up of infestation. The need for special care with regard to parasites may limit the use of pasture rearing under some conditions. Current observations, however, show that this form of management may lead to an effective control of parasites.

It has been noticed that suckled calves running with their dams rarely suffer from worms, although they are exposed to infested herbage from birth. It is probable that they acquire an immunity to the parasite, for observations at Hurley indicate that the amount of herbage they consume is very small for some weeks. It is unlikely, therefore, that they will take up more than a few parasitic larvae from day to day until several weeks old. According to the results of work being carried out by Michel at the Veterinary Laboratory, Weybridge, this low-level intake of larvae could build up an immunity to infestation. If this is so for suckled calves, it is probable that pasture-reared calves can attain a similar immunity provided they are turned out to grass soon after birth and the pasture is not too heavily infested.

Support for this theory of parasitic control comes from New Zealand, where pasture rearing has been used on several generations of cattle and the calves graze pastures recently vacated by the dairy herd without suffering seriously. The combination of good nutrition and an acquired resistance not only lowers the risk of infestation but reduces the general level of worm population on farms.

Generally, better results have been obtained under rotational grazing of small paddocks than under other systems of management. With strip grazing, there is a tendency to restrict the quantity and/or quality of herbage

on offer, the result being smaller liveweight gains. Set stocking gave poorer gains under New Zealand conditions and at Hurley: it may be satisfactory in the early part of the grazing season, but as the area of soiling increases, that available for grazing is reduced. The risk of parasites then increases, since the calves are forced to eat soiled herbage.

No comparison of species and strains of grass has yet been made, but satisfactory results have been obtained on perennial ryegrass/white clover and perennial ryegrass/timothy/white clover swards, and even on poor permanent pasture. The herbage should be kept relatively short and leafy.

Marked saving in rearing costs

It is apparent from work already completed that calves can be reared at pasture quite successfully, at least in the south. Although the system appears unconventional at first, it needs only a little reflection to appreciate that it is close to the natural method of rearing. More work is required to measure its long-term effects, but it has already been found that the rumen capacity of three-month-old calves reared at grass is three times greater than that of suckled calves of similar age and live weight fed on concentrates and hay.

The greatest benefit accruing from the system is the marked saving in rearing costs. Apart from the pasture—and eight to ten calves can be reared to three months on one acre—the total food costs have been as low as 70 shillings per calf, i.e., the current cost of one cwt dried buttermilk powder. Where supplies of fresh skim milk are available, feeding and labour costs can be reduced still further. Feeding calves in the field may be considered laborious, but we have not found it so. No disinfection of calf-pens is required and there is no daily cleaning out and bedding down. Milk substitute can be mixed at the farm and taken to the field by churn.

The raising of calves at pasture is an alternative to other methods involving the feeding of hay and concentrates, its adoption being governed largely by the relative price of such foods and milk products. With the prospect of a surplus of milk, it looks a better proposition to feed the milk products to more young stock at grass than to feed expensive concentrates. Such a system of rearing could also be used to raise beef cattle from many of the calves that are slaughtered every year. All that is required to make the system successful is to manage pasture intelligently so as to provide good-quality feed with little or no worm infestation.

Self-feeding in a Silo Barn

W. E. GELLING, B.SC., N.D.A.(HONS.), H. E. SHAW, B.SC., and J. B. HILL, N.D.A.

National Agricultural Advisory Service, Warwickshire

The unusual practice of clamping silage under the same roof as the animals for whom it is intended, and letting them roam freely on top of it, has worked well on a Warwickshire farm.

GIVEN a high standard of general management and suitable accommodation, there seems to be no reason why a simple system of storing and self-feeding silage should not work well on many farms. Take Burnt Heath farm, for example. This is an extensive arable farm (some 534 acres) a few miles from Leamington Spa, occupied by Mr. Sam Moreton. In March 1957 he decided that either additional economies would have to be made in the costs of producing milk from his 68 dehorned, attested Friesians, or an alternative enterprise would have to be put in. He found the answer in plans not only for the making of silage but the self-feeding of it in the ensuing autumn. This was short notice, but some one-year leys were available and he decided that he could use his Dutch barn to house both cows and silage, moving his machinery and implements elsewhere.

The silo barn

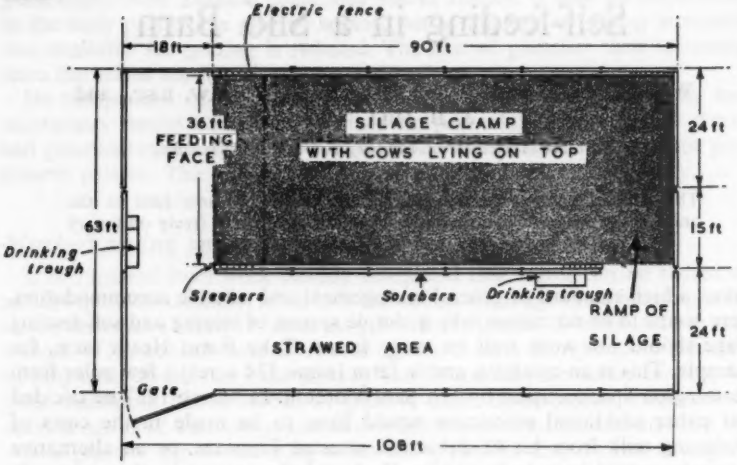
The Dutch barn was a triple-span, 6-bay building measuring 90 feet × 63 feet × 18 feet to the eaves. To this he added a lean-to, so extending the length to 108 feet. The floor of two of the spans (a 24-feet and a 15-feet) was concreted, and given a fall away from the feeding face of 1 foot in 90 feet. On this the silage was clamped. The remaining 24-feet span was strawed down to give additional accommodation. Sleepers were lodged in grooves in the concrete, and three small channels carried away the effluent. The dividing partition between the clamp and the non-silage span was built up to 8 feet with slightly sloping sleepers lodged in the grooves and resting on the bottom solebar between the stanchions. This solebar was kept in position on steel brackets bolted into the H-section of the stanchions. Additional solebars were placed above this one, to prevent the animals from stepping off the top of the clamp and to avoid accidents when the tractor was consolidating the silage.

The outside of the barn adjacent to the clamp was similarly built up to 12 feet and, from this, corrugated sheets reached to the eaves, except for one transparent sheet per bay which allowed daylight to enter. The other side was filled in with solebars to the corrugated sheets, again with a transparent sheet in each bay. Two bays each approximately 15 feet × 6 feet were left unsheeted to allow ventilation.

The remaining walls were built in such a way that the whole could quickly be removed, either to cart out the manure mechanically or to put the build-

SILO BARN

PLAN



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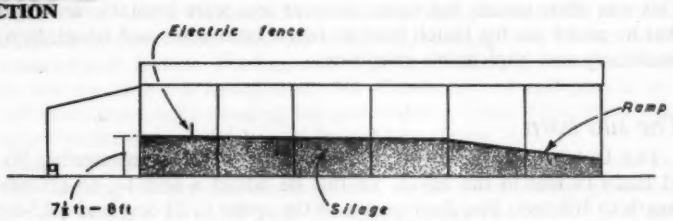

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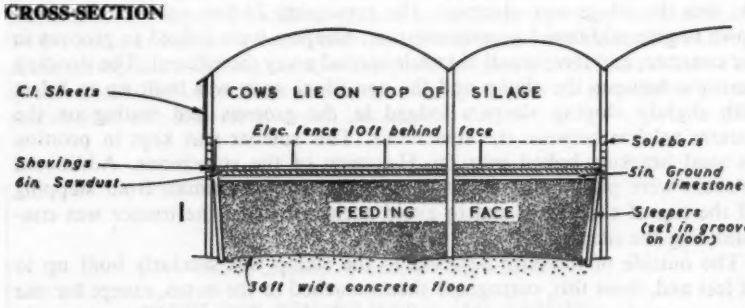

ing back to its original use. Special precautions had been taken to prevent any direct pressure on the stanchions themselves by fixing temporary supports to the bottom solebars. The concrete floor not only sloped lengthwise, but it had a fall of 2 inches in 9 feet towards the drainage channels. Electric light was also installed and used for the 21-hour access as required.

Silage stored and sealed

The silage material, cut mainly by forage harvester, was emptied by hydraulic tipping trailers on to a concrete apron, and then transferred by buckrake to the clamp built in the shape of a wedge. The final measurements of the clamp were 90 feet long, 36 feet wide and 7½ feet deep (average for the first four bays) tapering to 4½ feet at the gable end. The yield of settled silage was approximately 10 tons per acre.

After consolidating the clamp, 72 tons of carbonate of lime were spread over the surface, approximately 6 inches deep. On top of the lime there were 6 inches of sawdust and on top of this about 9 inches of coarse wood shavings. This surface was now available as part of the yarding area, so when allowance was made for internal measurements and fittings the area available to each of the 68 cows was 85 sq. feet or so. The surface of the clamp, which was approached by a ramp, was actually providing more than half the total surface area available. An electric fence erected above and inwards from the silage face prevented accidents to the animals on the upper surface.

The sealing material was removed from the surface area, half-bay width fortnightly, and carted on to the land. The electric fence was then re-positioned and fresh shavings distributed on the "deep litter" area. At first about 70 bags of shavings, weighing an average of 40 lb, were required weekly, but considerably less were needed as the surface area was reduced and straw was applied to the increasing ground area. The surface material remained in a very friable condition throughout the whole of the feeding period; in fact, the cows generally preferred to lie on this area, no doubt because of the heat coming from the silage below. No physical treatment, either by hand or machine, was applied to this surface material throughout the feeding period; the movement of the animals appeared to provide ample action for the absorption of the dung and urine. The concrete from the feeding face to about 10 feet away was kept clean by removing the manure from it in a muck spreader twice daily. About one man-hour was spent each day in cleaning the concrete and bedding down the strawed area, and nine man-hours fortnightly removing lime and litter from the top of the silage and re-positioning the electric fence.

Feeding

Except for milking periods, the cows were housed in the silo barn for 150 days (14th November 1957 to 13th April 1958). They remained in the cowshed until the milking of the herd was finished, so giving them ample time to consume their hay and concentrates. About three hours a day were spent during these milking periods standing on clean concrete, which may have been partly responsible for the herd's freedom from foot troubles. The animals actually had access to the silage for 21 hours a day.

At first, the cows grazed fairly evenly along the face, but later, when they came to some variable material, they tended to burrow more deeply here and there. To ensure a more regular grazing of the face, the problem was solved by putting in two parallel, horizontal 2-inch metal tubes, supported on 5-feet metal rods driven into the silage. Six feet high appeared to be the

maximum to which the cows would graze. Any silage above this height was carted to other stock—an extra problem no doubt, but offset by the saving already gained in storing the material. It was calculated that the average consumption per day was 90 lb per head. This amount was based on density weighings which varied from 42 lb per cubic foot in the upper layers to 70 lb in the lower layers. The average density per cubic foot of a section 7 feet deep was 60 lb or approximately 1·4 cubic yards per ton.

Periodical reports from the N.A.A.S. nutritional chemist showed that the bulk was well made and of medium quality. Considering the difficulties experienced in making silage in 1957, we were pleased with the result. The average analysis was as follows:

Dry matter	Starch equivalent (est.)	Digestible protein (est.)
per cent	*per cent*	*per cent*
27·4	12·1	2·1

During the milking periods the cows received hay at the rate of 2–3 lb daily, and this was observed to be the maximum that any one would eat. Some ate less. The silage and hay together proved to be ample for maintenance and the first 1½ gallons daily, so concentrates were fed at 3½ lb per gallon over that quantity during the milking period. The mixture, containing approximately 72 per cent S.E. and 15 per cent D.P.E. was made up by weight as follows:

5 parts groundnut cake		
6 „	maize	plus 1 cwt minerals
6 „	barley	to 1 ton of the mixture
3 „	oats	

Considerable saving was made in the feeding costs. If silage was valued at £2 10*s*. per ton, hay at £8 per ton and the concentrate ration at its then current price of £26 per ton, the average feeding cost of the four-gallon yield was one shilling per gallon. Milk from a two-gallon cow cost (for feeding-stuffs alone) 1*s*. 3*d*. per gallon. The average quantity of concentrates used over the feeding period did not exceed 2½ lb per gallon for the milk sold. The general feeding policy appeared to be most satisfactory. Yields were good and the animals were the picture of health. Neither diseases nor physical defects were experienced throughout the whole period.

Milk yields and quality

Sales of milk during the observation period started with 221 gallons on 15th November 1957, rising to the peak yield of 297 gallons on 6th January 1958 (that is, over 4¼ gallons average from 68 cows). When the self-feeding period ended on 13th April, 208 gallons were disposed of from 70 cows. The winter daily output was reasonably constant and no doubt the quality of the animals had a lot to do with this. Over 60 per cent of the herd were first-calf heifers and had calved in October, and 30 per cent second calvers also calved in October. A number of animals had yields of 7 gallons daily. Three tests for butter fat and for solids-not-fat on the bulk milk taken during the self-feeding period showed that the butterfat level had been maintained and there was nothing more than the slight seasonal decline in the solids-not-fat normally associated with autumn calving herds.

Animal behaviour during self-feeding

We also watched the behaviour and habits of the cows whilst they were housed in the silo barn, taking counts of the number of cows at the feeding face every 5 minutes throughout a period of 24 hours in March. The feeding face accommodated only 18 cows at any one time (that is, 36 feet of face, allowing 2 feet per animal) and on only one occasion was the face fully occupied. The average number was 13 during the day and 11 during the night. More cows were at the feeding face during the first hour after milking than at any other time, and relatively few cows were feeding immediately before milking. The cows were equally ready to cross the yard to be milked and to return to the silage face after milking.

Temperature recordings were consistently higher inside than outside—by 10°F in the late evening and 5°F average over the twenty-four hour period.

Discussion of the study

Under Mr. Moreton's system of self-feeding, an allowance of 6 inches per cow was adequate for a high-yielding dehorned herd with 21 hours access to the clamp. The average total time spent at the face per cow was 3½ hours and there were wide variations from this average, both as regards frequency and length of feeding period. One cow was self-feeding for a total of only 1 hour 25 minutes out of the 21 hours, and another cow for 5 hours and 10 minutes. Some cows went to the face only occasionally but stayed there a considerable time; for example, four or five times for a period of up to one hour each time. Others went more frequently for shorter periods. One animal went to the feeding face no less than seventeen times. Ten minutes was about the lowest average time spent per cow in any continuous feeding period.

No particular characteristic appeared to be responsible for individual variations. The milk records were carefully checked with a view to discovering whether feeding habits were related to the age of cow, number of lactations, stage in lactation, milk yield, and the teeth of the cows, but we came to the conclusion that the length of time spent at the feeding face was in no way related to any of these factors.

It was not possible to weigh the cows before and after the feeding period, but observers considered that the herd had at least maintained its body weight and had carried a "summer" coat throughout.

That Mr. Moreton's arable farm has influenced the success of the system to date is readily admitted. Land, labour and litter are of fundamental importance in an enterprise of this kind, whilst husbandry, machinery and livestock management largely control the success of the venture.

The writers are grateful to Mr. Sam Moreton and his staff for their enthusiastic co-operation, not only in connection with the investigations but in so generously welcoming visitors to see the system in operation throughout the whole period.

Prepacking of Fresh Fruit and Vegetables

G. H. STANSFIELD, B.SC.(HORT.)
Ministry of Agriculture, Fisheries and Food

Prepacking is a logical development from new methods of retailing. Last month's International Conference and Exhibition of Prepacking, referred to on p. 419, have shown Britain taking the lead in this aspect of modern marketing.

IT is estimated that there are now over 300 firms prepacking in this country, with an annual output of some 180 million prepacks. Some of them deal only with seasonal crops and often handle only one product. Others are engaged in general prepacking and handle various products in season, imported as well as home-grown. Apart from isolated instances, it was not until 1950 that prepacks began to appear in small quantities from packing-houses specially set up for the purpose. Only five firms were known to be prepacking early in 1954, but by the end of the following year the number had risen to about 70 firms. Expansion continued thereafter, both in the number of firms entering this field of marketing and in the degree of mechanization.

The post-war revival of prepacking was mainly the result of the growth of the self-service method of retail sale. Since 1947 the number of self-service stores has grown steadily to a present total of 4,500. New stores are opening and conversions from conventional methods of sale are taking place at the rate of about two every day. Some of them are concerned with grocery only, but others, possibly as many as half the total, stock prepacked fresh fruit and vegetables.

Place of prepacking

Prepacking can take place at any one of a number of points in the chain of distribution linking farmer and consumer, but naturally, to secure economic operation, the packing-houses are, wherever possible, sited where the crop is grown. Thus potatoes and carrots are packed in East Anglia, apples in Kent and Essex, and tomatoes in the Lea Valley and Worthing areas. Prepacking may thus take place either at the farm itself and be operated by the farmer, or at a packing-house owned by a country merchant elsewhere. Such farmers and country merchants are used to operating on a large scale and have developed their normal distributive interests to cover prepacks in addition to conventional sales.

Potatoes are a good example of a crop particularly suited to localized packing. The packing-houses are usually run by potato merchants, who have their own wholesale outlets and can be assured of a continuous supply through their trade contacts. Not least, they have also the capital necessary to install high throughput machinery. Output varies enormously. The majority operate at the rate of 100–150 tons per week, but individual packing-

houses process from 25 to 300 tons per week. The disadvantage of packing in the production area is that work tends to be on a seasonal basis. On the other hand, the disposal of waste material and of low-grade produce unsuitable for prepacks is easier.

While packing-houses in the production areas tend to concentrate on a few local crops and are therefore geared to production, packing-houses near the consuming areas are geared to the consumer and concentrate on supplying a variety of prepacked produce. Packing near the ultimate market is carried on either by wholesalers or by retail shops. Some chain stores also have central packing-houses.

Wholesalers who operate packing-houses have the advantage of ready access to a variety of produce imported as well as home-grown. Though they can use their wholesale contacts to dispose of their packs, these are generally supplied against firm orders and seldom appear physically on the wholesale market.

Retailers are themselves not anxious to prepack if they can obtain supplies elsewhere. Produce which they cannot get prepacked is obtained in bulk from the wholesale market and prepacked on the premises. But there are disadvantages in this: space is limited and the disposal of unsuitable material difficult, also the produce is often mature and consequently more easily damaged.

The packing-house which serves a chain of self-service stores is similar to the wholesale one in the type of equipment installed and in the output. The products packed include both imported and home-grown, but are generally confined to those which are relatively easy to prepare and have little wastage.

Kinds of produce prepacked

Prepacked potatoes now account for about 60–70 per cent of the annual output of prepacks. The development of potato prepacking really got under way during the 1956–57 seasons. To start with, 150 tons were being prepacked weekly, but by the height of the season the figure had risen to 3,000 tons per week. Altogether, about 70,000 tons (about 3 per cent of the total retail sale of potatoes) were prepacked by nearly 100 potato packers. Output more than doubled during the 1957–58 season, and prepacked potatoes now account for 8–9 per cent of the total retail sales.

The reason for this tremendous increase is that prepacked potatoes are popular with the housewife, since they are cleaner and easier to handle than is the loose produce. Retailers like them for the same reason. As they are not easily bruised, they lend themselves to mechanical handling, and much of the new British machinery has been designed specially for them.

Products which are usually peeled before use, bulky produce and goods normally sold in single units do not naturally lend themselves to prepacking; although there are exceptions—for example, oranges are often prepacked in units of two, four or six. Certain crops such as watercress, radishes, and spring onions are usually sold by the bunch, though occasionally they are sleeve-wrapped with transparent film.

The packing of a number of related vegetables in composite packs, such as stewpacks and salad packs, is obviously very popular since it saves the consumer the time and trouble of buying the products individually.

Types of prepack

There are three main types of prepack—the bag, the carton, and the direct overwrap—their use depending on the value of the produce and the degree of protection required. Thus bag packing is the most popular for root crops and for produce which does not damage easily. Various types of cartons (often covered with transparent film) have been devised for particular crops, but these are generally reserved for the more expensive ones and those needing some protection: for example, apples, tomatoes, and mushrooms. Fibre-board trays make a useful base for produce that is to be overwrapped. This form of packing is also reserved for the more expensive fruits.

Polyethylene film is the most popular material for bags, but besides that there are cellulose films, kraft paper, and net and mesh containers. Recently polyethylene net in sleeve form has become popular. The produce is fed into it and the packs formed by cutting and sealing the ends.

The method of closing bags largely depends on the material used. The commonest methods are by stapling, with or without header labels, wire strip fasteners, gummed or pressure-sensitive tapes, and by heat.

Increase in mechanization

Mechanization in prepacking has developed markedly during the past two years. Packing-houses today have the appearance of factories, and indeed factory methods are used to achieve the high degree of efficiency required to turn out large quantities of uniform packages. New methods have been developed to handle horticultural produce, and the three main methods of mechanical packing which have been evolved are the bagging machine, the return-flow belt system and the overwrapper.

Bagging machines are semi-automatic or fully automatic, in that they weigh a given quantity of produce which can be tipped into a bag. One of the latest types makes its own bags from a reel of polyethylene sleeving, automatically weighs the correct amount of produce, and fills the bag which is automatically opened and presented to the mouth of the tipping produce scoop. Flow-return belt systems consist of two counter-travelling conveyor belts on which a constant stream of produce passes the weighing operators stationed at points around it.

Overwrapping machinery of the fully automatic type used for other food products for many years has been adapted for overwrapping cartons of horticultural products. Such equipment is very expensive, and a high rate of output must be achieved if the capital cost is to be justified. Semi-automatic overwrappers and sleeve wrappers have also been installed for carton packing, particularly by the specialist apple packers.

Washed potatoes are becoming more and more popular, and it has been estimated that during 1957–58, 10–15 per cent of prepacked potatoes were washed. Vegetable washing machines followed by heat driers have been incorporated in the prepack line. Dry brushing of potatoes is also practised, particularly if the crop is grown on a soil which can easily be removed by this method.

Existing buildings and packing-houses have often been used, but many new buildings have been required to accommodate packaging lines. It is

probable that up to £1 million has been incurred as capital investment for plant and buildings.

Use of non-returnable containers

Prepacks need to be protected on their way to the retailer, and an increasing number of non-returnable outer containers is now being used. The retailer likes them because his storage space for returnable empties is limited. Many supermarket operators and large retailers are accustomed to handling other foodstuffs in non-returnables and therefore look with disfavour on the extra accounting and handling necessitated by the use of returnable boxes.

For bag packs, where the product is not easily bruised, large polyethylene outers and multi-wall kraft paper bags are popular. The paper bags are particularly useful for prepacked potatoes because they prevent greening.

More non-returnable fibreboard boxes and trays are being used as containers which are specially made to hold a specified number of prepacks.

Distribution

The general pattern of distribution of prepacks is influenced largely by the development of self-service stores. In the south and east of the country, where there is the largest number of self-service stores, much of the produce is delivered directly to the shops or to the central warehouses of the chain of stores. Though they were at first reluctant to do so, the wholesale markets are now handling prepacked produce.

The provincial wholesale markets of the north and west are increasing their business in prepacks, particularly with potatoes and carrots. These two crops can be sold independently of self-service. As much of the trade is for firm orders, very little prepacked produce is sent to market in the normal way for sale on commission. The wholesale business is therefore generally used only as a convenient form of distribution. A producer-controlled company, the Central Horticultural Exchange Ltd., was formed to sell the prepacked horticultural products of its members direct to retailers on a commission basis. This company started trading in the Midlands early in 1957, and later the same year opened a distributive centre covering the London area.

The rapid development of prepacking in the last few years has made a quiet revolution in the marketing of fresh produce. Although the future is unpredictable, the possibilities are enormous as more and more produce is prepacked and marketed under clean, hygienic, and attractive conditions.

Rabbit Control in Australia and New Zealand: 1

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The subject of this article has often been mentioned in *Agriculture*, mainly in connection with the virus disease myxomatosis.* It was to study this disease and its effect upon methods of rabbit control that visits were paid to Australia and New Zealand in 1957–58.

CONSIDERING the rabbit control problems of Australia and New Zealand, the immediate impression is perhaps of the differences between the two countries. Australia is geologically old, a vast grey continent, very different from Europe and quite close to the frontiers of civilization, once the corrugated iron roofs of the suburbs are left behind. There are thousands of acres of dead trees, girdled to clear the land for grazing—and potential erosion—great lakes that disappear every few years as the level of the water-table alters and everywhere the Bush. Eucalypts 200 feet high in Western Australia, paper-barks and *Pandanus* palms fringing lily-lagoons in the Northern Territory, hundreds of miles of salt bush and ghostly blue-bush on the Nullarbor Plain, and vast areas of *Spinifex* round Marble Bar, are all the Bush.

By comparison, New Zealand, with its recently active volcanoes, earth tremors, hot springs and higher rainfall, seems incredibly green and, rather surprisingly, very like Britain, which it resembles in many things besides climate and size.

Tasmania is unique; with a climate cooler than much of New Zealand, it is, of course, physically, biologically and politically very much a part of Australia.

Early attempts to introduce the rabbit into Australia and New Zealand failed, but it was successfully imported in the mid-nineteenth century, and it seems likely that in both countries, as man forced his way into the Bush, the rabbit followed; and as he developed a rabbit industry in skins and carcasses, the rabbit thrived. Evidence is accumulating from several parts of the world that the European rabbit is favoured by the sort of habitat created by man's agricultural activities, which produce close-cropped grass and nutritious young cereals.

Far-sighted landholders in Australia have battled continually against the rabbit, as the thousands of miles of rabbit-netting around individual properties and the cattle-type grids across the roads bear witness. The tradition of successful rabbit control is to fence the property, hunt the rabbits with gun and dog, fumigate and poison, and finally rip the warrens with a deep plough. After that, it is still necessary to ride the boundaries and be ever on the alert to deal with infiltrating rabbits. But there have always been some graziers and farmers who do not realize that a few rabbits are potentially dangerous, and others who have ill-advisedly tried to make a profit from the sale of rabbit skins and carcasses.

* See references on p. 392.

It was much the same story in New Zealand only ten years ago, since when the activities of the Rabbit Destruction Council and the Rabbit Boards have brought the numbers of the rabbit lower today than they have been for ninety years.

Myxomatosis

For over thirty years the use of myxomatosis for the biological control of the rabbit has been considered, but all attempts to start an outbreak were unsuccessful until the Australian experiments on the Murray River flats in 1950. Accustomed as we are in Britain to frequent gentle rain, some adjustment is necessary when living in a country where, although violent floods occur, rainfall is often spoken of in hundredths of an inch and is likely to evaporate almost as soon as it falls. The relatively wet seasons experienced in Eastern Australia since 1950–51 have made an annual spring/summer epizootic of myxomatosis a regular event, and it needed the drought of 1957–58 to emphasize the dependence of myxoma outbreaks upon the numbers of mosquito vectors, and their dependence in turn upon suitable climatic conditions. In retrospect, and after referring to figures for annual rainfall, it is apparent that, fortuitously, the release of myxomatosis at the now classic sites of Gunbower and Corowa on the Murray River in 1950 were singularly well-timed. The river flooded the lagoons and billabongs, inundating a vast area, and the resulting abundance of mosquitoes soon made contact with the recently infected rabbits. The first epizootic spread so rapidly and so unexpectedly—just when the research workers were considering winding up their inoculation experiments—that it can have received little assistance from landholders. It was in subsequent years that the demand for State inoculation campaigns arose and, since this raises once again the question of the value of myxomatosis as a means of rabbit control, some recapitulation is necessary.

In Dame Jean MacNamara, a Melbourne pediatrician, the myxoma virus has had a staunch champion. She campaigned for its introduction in the 1920s and continued to believe in it as an agent of biological control of the rabbit, even when the field experiments carried out in the 1930s were unpromising. Before visiting Australia, I had not realized that the public discussion of myxomatosis in 1948–49 had scarcely been less virulent than the disease itself. Having been vindicated in her fight for the virus, it is natural that Dame Jean should continue to believe in the efficacy of myxomatosis, despite the dominance of attenuated strains in Australia and the evidence that the genetic resistance of the wild rabbit population is rising.

The situation is complex, in that the virus is widely distributed throughout Australia and, when conditions for spread are unfavourable may, as in Britain, remain undetected in rabbit populations, causing only an occasional death. The specific mosquito and other vectors vary from place to place, as do the climatic conditions which favour their maximum production. While the answer to a widespread attenuation of the virus might seem to be a campaign of artificial inoculation of virus of high virulence, it is extremely difficult to synchronize this with vector abundance. And even if this is achieved, it is only a short time before the attenuated strain, with its more persistent skin lesions and greater infectivity, displaces the highly virulent

one. It seems likely, from the work of Fenner, Marshall and others, that variations in the innate resistance of unselected rabbit populations are considerable, and that natural selection will result in a gradual increase in the resistance to myxoma of rabbit populations generally. This would further reduce the efficacy of inoculation campaigns which, since they involve the capture and maintenance of live rabbits, are invariably cumbrous and frequently inefficient.

It is clear that myxomatosis will remain a disease of rabbits in Australia, that it may sometimes kill considerable numbers, but that as a reliable and consistent means of control it has little to commend it. The disease has amply demonstrated to graziers and farmers the greatly increased production that can be achieved in the absence of rabbits, and the need now is to develop an efficient rabbit control organization in every State.

Attempts by the Department of Agriculture to introduce myxomatosis into New Zealand in the summers of 1951–52 and 1952–53 were unsuccessful. More than 3,500 rabbits were inoculated with the disease and either released or maintained in netted enclosures. In a few areas some naturally infected rabbits were seen but, although numbers were reduced locally, the disease did not spread.

It seems likely that New Zealand does not have the necessary insect vectors to produce a myxoma epizootic. The European rabbit flea is not present in New Zealand and, compared with Australia, mosquitoes are scarce, probably because of low winter temperatures and a scarcity of stagnant water for breeding.

There is little doubt that the failure to establish myxomatosis in New Zealand has helped the campaign of rabbit destruction rather than hindered it. The fact that myxomatosis has not solved the rabbit problem in Australia has been an object lesson to New Zealanders, assuring them of the validity of their own policy. Over most of New Zealand rabbits have been reduced to as low a level as anywhere in Australia, with the difference that in New Zealand an organization exists which is capable of keeping them at that level.

Control in Australia

Legislators have been aware of the rabbit problem for some eighty years, but responsibility for control rests with individual States and there is great variation between them, so that about the only common factor is that the onus of rabbit control on private property lies on the individual occupier. In Victoria, Queensland and South Australia vermin control is a function of the Lands Department (although myxomatosis is dealt with by the Department of Agriculture in South Australia), while Western Australia has an Agriculture Protection Board operating through the Department of Agriculture, and District Vermin Boards. New South Wales has a complicated system of 59 locally elected rate-levying Pasture Protection Boards which supervise the activities of Stock Inspectors, Rangers and Rabbit Inspectors, while the Boards themselves are loosely supervised by the Department of Agriculture. The Tasmanian Department of Agriculture has a very efficient Vermin Control Branch, operating under the Chief Veterinary Officer and based on rigorous inspection of infestations and poisoning with sodium fluoroacetate.

Vermin control in all the States suffers to some extent from employing an inspectorial system (as opposed to the "killer policy" of New Zealand) and sometimes from lack of single-mindedness. In New South Wales the Pasture Protection Boards, which have been in their present form since 1934, are responsible through their Stock Inspectors for the registration of notifiable diseases and the investigation of other diseases, and through their Rangers for rabbit control and the supervision of stock routes. The Rabbit Inspectors survey private property, while rabbit destruction squads operate only on State stock reserves—where stock are held overnight when they are being moved along stock-routes from place to place. The rabbiters also spend about one-quarter of their time controlling noxious weeds. The interests of the Pasture Protection Boards are thus divided and there appears to be little co-ordination between them.

Western Australia

Since 1951, the Vermin Destruction Branch of the Department of Agriculture in Western Australia, operating under a State Agriculture Protection Board, has developed an efficient system of rabbit control units which rely heavily on the help of landholders for their operation. Each unit consists of one man with a Land Rover, caravan and equipment. There are twenty units in all, operating only in the valuable agricultural land of the south-west corner of Western Australia under the general control of a supervisor and the immediate control of regional officers. Poisoning with sodium fluoroacetate (1080) is the preferred method, and the usual procedure is as follows. The landholder, with advice from a vermin control officer if necessary, ploughs a shallow furrow close to all rabbit warrens and infested scrub, and this furrow is "fed" for three days with unpoisoned bait, usually oats but sometimes carrot or apple. Stock are moved to another part of the holding. The unit comes in to do the poisoning on the fourth day; usually the landholder drives the Departmental Land Rover and the operator lays the poisoned bait. The co-operation of the farmer or grazier is important in keeping down the costs of treatment, since he may spend as much as ten days on the work and draw sixty miles of furrow. Nevertheless, some landholders would prefer to have the entire job done for them. One of the difficulties of farmer participation is that of arranging poisoning drives over a wide area which will also suit the convenience of the many occupiers. Most of them prefer to do the work in late summer or autumn, so that rabbit destruction tends to be seasonal.

In addition to poisoning, the Department of Agriculture believes firmly in warren destruction and has three ripping units, each consisting of a D 4 caterpillar tractor, with a special front-end ripper giving 32 inches penetration, and the transportation truck with overnight accommodation for the driver. The rippers are operated on a subsidized basis to encourage landholders to use them.

Although the present system is working fairly satisfactorily, it is difficult to get complete coverage, even in the high production country, and it is believed that a closer approach to the "killer policy" operated in New Zealand is necessary.

Action in Tasmania

For some time after its establishment on the mainland, it was illegal to introduce myxomatosis into Tasmania, and although it was eventually introduced it has never swept across the island and has not been allowed to weaken the very effective control campaign begun in 1950. Before that date, reliance upon traps and the piecemeal use of inefficient poisoning methods had resulted in little impression being made upon the rabbit problem. The success of the Vermin Destruction Section of the Department of Agriculture rests upon the efficiency of its chief officers, their fourteen District Inspectors (who also supervise poisoning operations) and the three mobile teams each of two men, which destroy rabbits on Crown land and on the property of landholders seeking official assistance, or failing to comply with the Vermin Destruction Act. Much of Tasmania is covered by forest, and the rabbits present a problem on some 11,000 holdings, or an area of about 6½ million acres. Tasmania has pioneered the use of sodium fluoroacetate for rabbit control and practical techniques are based on laboratory tests and field trials. As in Western Australia, a ploughed furrow is carefully drawn near the areas of rabbit harbour and feeding grounds, and the furrow pre-baited with plain food for several days before the poisoned baits are laid. Poisoning goes on all the year round and, while apples are the principal bait, landholders are encouraged to grow special crops of carrots and turnips.

Strict precautions are observed in the handling of sodium fluoroacetate. All supplies are under the control of the Department of Agriculture, standard solutions of the powder are prepared centrally, and unused or uneaten poisoned bait is buried. This poison, unlike strychnine which was once widely used in Tasmania, does not produce obviously painful symptoms in rabbits, but it is also highly toxic to sheep. It is therefore considered essential to remove stock from a poisoned area until all baits have been picked up, covered with soil or weathered. Sodium fluoroacetate is particularly lethal to dogs, and it is necessary to have them muzzled or otherwise restrained during a poisoning operation. As in Western Australia, fears that the use of sodium fluoroacetate would cause heavy casualties among the interesting wild fauna of Tasmania, particularly the ground-living marsupials, have not been borne out in practice.

Part 2 of this article will appear in the next issue of AGRICULTURE.

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Colorado Beetle

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A keen look-out is still needed to support our stringent controls directed against Colorado beetle. The insect is no respecter of regulations.

FRIENDS from overseas often tell us that as we live on an island nature helps to protect us from the introduction of plant pests and diseases. There is an element of truth in this, but it does not relieve us of the need for constant vigilance. In spite of our isolation, there are several ways in which important pests and diseases can enter the country, and the records of Colorado beetle discoveries from 1947 to 1957 provide an interesting illustration of some of them. Over and above their intrinsic interest, however, they provide a most important aid in the planning of policy to protect our country from Colorado beetle.

The general nature of the dangers was realized before the beetle appeared in Europe, and the first record of a Colorado beetle being found on a ship in this country was at Liverpool in 1877, on a boat from Texas. It was also found at Rotterdam in 1877, and on a ship at Bremen the year before, and established its European bridge-head in the neighbourhood of Bordeaux about 1920. The earliest outbreaks in this country were at Tilbury in 1901 and 1933. The risk of introducing Colorado beetle on vegetable produce, in particular on potatoes and parts of the potato plant, was quickly recognized, and powers were taken by the Privy Council in 1877 to prohibit or regulate the landing of dangerous produce at British ports. Action under these powers was intensified when the beetle became established in France, and they still form the basis of our regulations. It is interesting that our first discovery of infested vegetables was reported as recently as 1946.

Figures 1 and 2 (on p. 393) illustrate the total finds of Colorado beetle associated with vegetable produce on ships and other means of transport for 1947–52 and 1953–57 respectively.

The two periods have been shown separately to illustrate several points of interest. The degree of the risk of Colorado beetle being carried on vegetable produce and transport depends largely on the number of beetles in the infested areas, the volume of trade and traffic, the time of year, and such measures as exporting and importing countries may themselves take to reduce the danger. In a very general way our findings have reflected these influences, but two things stand out. Firstly, as would be expected on theoretical grounds, the transport danger is at its height in the late spring and summer when beetles are likely to fly about in infested areas, alighting frequently more or less at random. This danger is clearly of little, if any, importance from October to March, and greatest in May, June and July, although the risk cannot be ignored in the other months. The second feature is that many more beetles were found in 1947–52 than in 1953–57 (here it should be mentioned that in 1947 more than 120 beetles could not be classified accurately,

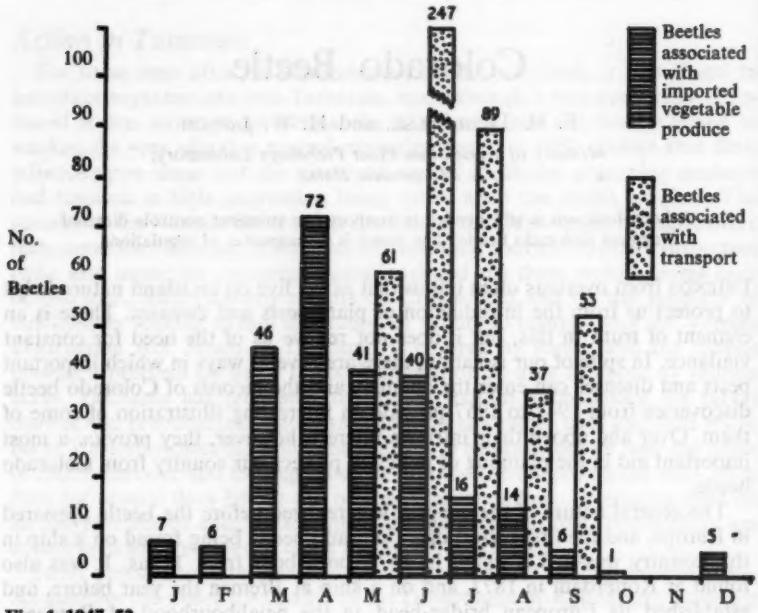


Fig. 1 1947–52

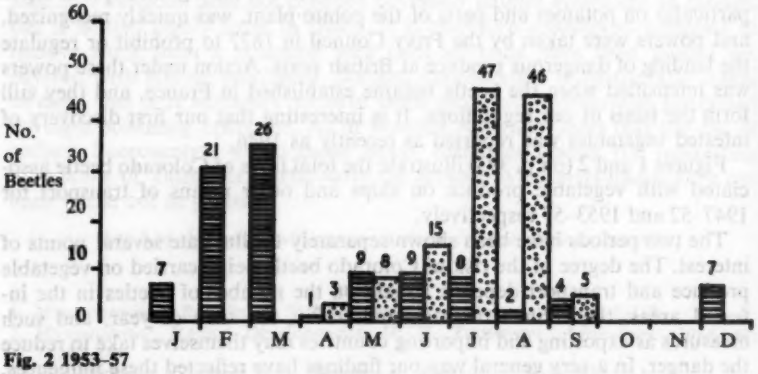


Fig. 2 1953–57

but many were found near airports and a number of others were probably associated with imported produce). This finding is probably correctly attributed to the strenuous and generally successful efforts that several European countries have devoted to control measures. A third point of interest is that from 1953 onwards there has been a conspicuous drop in the number of beetles found on imported produce after March. This is certainly due to the more severe import regulations introduced in 1953.

In short, the English Channel protects us from direct spread, so that the risk of introducing Colorado beetle is related in a general way to the number and activity of beetles in infested regions; and the chances of their passive dispersal depend on the volume and nature of traffic from infested to clean areas. The number of beetles in an infested area can be kept down by well-planned control measures, and traffic in particularly dangerous produce can be regulated to reduce the risks to an importing country. On the other hand, the activity of the beetle cannot be altered in the sense that its general biology is unlikely to be affected significantly by control measures, and not at all by regulations. The risk therefore exists when the adult beetle is present and active and its magnitude is related roughly to the total number of beetles.

Figures 1 and 2 illustrate some of these effects, and because they are least dependent on modifying factors, the "transport finds" will be considered first.

Beetles and transport

Colorado beetle is generally said to hibernate in the soil or in debris, although for reasons that will be mentioned, there is evidence to suggest that in certain areas overwintering does not involve complete inactivity. In northern countries, however, there is complete dormancy, the beetles emerging in the spring at a time which depends largely on temperature and varies according to latitude and altitude. In the regions closest to Great Britain, emergence may start in April, but as a rule is not at its height until May, or even early June. At this time the beetles fly when weather conditions are suitable and they may land on ships in inland waterways or small ports, on merchandise being loaded and on motor cars or aircraft on airfields. Most beetles have been found on boats coming from France and Belgium and Spanish ports in the Mediterranean. As would be expected, the finds on and associated with transport fit in well with the biology of the beetle, for in eleven years only three have been reported in April. In May and June, flights become more frequent and so do our finds, which continue until September.

The relatively high peaks in Figures 1 and 2 can be misleading if one tries to deduce too much from them. For example, one can deduce that the danger was greater in the 1947–52 period than in 1953–57, and that this was because infestation was then far heavier in the affected countries than it was latterly. On the other hand, it would probably be wrong to argue that in general there is a wide monthly variation in the risks, as might be suggested by the figures. In fact, during 1947–52, considerable numbers of beetles were found simultaneously; for example, in June 1948, 60 were found on one ship. Of the 487 "ship" beetles accounted for in Figure 1, 279 were found in 1948, many of them in fairly large aggregates. Similarly, the July and August numbers in Figure 2 have been swollen by finds of as many as 16 beetles at a time.

Beetles and vegetable produce

The first question that arises on seeing the figures for these finds is: why do they fall off in the season when the beetles are active and shown by the ship figures to be very liable to be transported accidentally? The answer is that the importation of vegetables known to be likely to harbour Colorado

beetle is regulated by the Importation of Plants Order, 1955. For example, it has been clear for many years that imported lettuce is particularly dangerous: in 1952, for instance, 41 out of 49 beetles found between 1st January and 5th April were associated with this crop. Until 1952 it was believed that the real danger started in April, and from the first of that month all dangerous vegetables had to be covered by a certificate of health designed to minimize the risk. It is probably for this reason, coupled with the fact that from May onwards home-grown vegetables reduce the need for imports, that the numbers of beetles found in this way did not mount to a summer peak.

In the early part of the year, European imports of leafy fresh vegetables are mainly from south of latitude 46°N, and from 1953 onwards the health certificate has been necessary from 1st March for such vegetables grown in districts south of this latitude. It is believed that the discovery of only a single beetle during April for five seasons amply justifies this move. Furthermore, most of the beetles recorded in March were found during the first few days on produce landed in this country before 1st March, and several on lettuce accompanied by certificates of doubtful validity. Similarly, in 1947–52, many of the April beetles were probably present on vegetables landed before the beginning of the month.

It might next be asked: why are beetles found on vegetables during the winter? They are first found in December, when French and Spanish lettuce begins to arrive, but there seems little reason to doubt that they would be found in October and November if lettuce imports then were heavy. These discoveries are the main reason we have for doubting that the Colorado beetle invariably passes the winter dormant in the soil; the beetles are generally quite active when received, and undoubtedly capable of surviving until the spring if they can find suitable cover. It is possible only to speculate about their origin, but it is known that in some of the areas they come from there is an autumn generation on the egg-plant, and that rows of egg-plants are interplanted with lettuce to mature from late November onwards. It is thought that when the egg-plants have finished cropping and are removed, Colorado beetle may find adequate protection in young lettuce plants and other vegetation without having to burrow into the soil; or autumn beetles that have pupated in the soil may emerge soon afterwards instead of waiting until spring. Inquiries have often been made in the areas concerned, but we are still little nearer to an answer to this question, mainly it seems because the biology of the Colorado beetle has not been adequately studied in them.

How Colorado beetle is discovered

Compared with the great amount of traffic between the Continent and this country and the large quantity of vegetables imported, the number of beetles found is fairly small. It would be impossible for the Ministry's officers to search everything everywhere and, in fact, they have discovered very few of the beetles referred to in these notes. Practically all of them have been found by the public and reported to the Ministry, the police or other authorities. Members of ships' crews, dockers, customs officials and travellers have all found and reported beetles; many have been found by housewives when preparing salads, by greengrocers, market workers and schoolchildren. To all these people the Ministry and the farming community feel deeply grateful,

for without their interest and co-operation it would have been difficult to frame regulations and to keep this country free from Colorado beetle. It is still important to keep a careful look-out for the insect.

Colorado beetle in 1957

No breeding colony was reported in 1957, but 48 individual beetles were discovered, as compared with 51 in 1956 and 54 in 1955. Forty-one were discovered amongst imported vegetables, of which 16 found on onions from Spain have been recorded as "ship" beetles. Ten were found on lettuce—9 from Spain and 1 from France; 6 on potatoes—4 from Spain and 2 from Belgium. Three other beetles were associated with mixed vegetables and fruit from Spain; 2 were probably imported on French cauliflowers, and 2 were on lettuce of uncertain origin. One was found on timber from France and one on rice from Italy.

Of the remaining 7 beetles, 5 were found on ships or at or near ports, and the others inland.

Ringing Grassland Changes

Few things reduce grass output more than treating fields in exactly the same way year after year. If a field must always be grazed and never mown, it is a good idea to vary the grazing from one year to the next; a field used for early bite this year should not be managed for early bite next year. So pastures which were grazed early in 1958 might well be grazed again now, and then managed to provide keep for the late spring or early summer of 1959.

The same principle applies to mowing ground. Try not to hay the same fields every year. More fodder will be grown if the fields cut for hay this year are cut twice for silage next year, three times the year after and mown for hay again the year after that, the whole cycle being repeated. A change in cutting management keeps up output and helps to make the most of fertilizers, especially nitrogen. Few things spoil meadows more than stepping up nitrogenous top dressing each spring and using them permanently for hay. If fertilizer programmes are intensified, management programmes must be altered. When farm layouts permit, cutting and grazing should be alternated. This improves total output and brings greater profit.

With short leys it is different. Leys of 2–3 years designed specifically for grazing or cutting are more productive than dual-purpose leys of similar duration. A more rigid pattern of management is, therefore, permissible, but even short leys should be varied wherever possible. Flexibility is the cornerstone of grassland management. It can be achieved by varying the type of cattle grazing, introducing sheep whenever possible, and applying nitrogenous fertilizers at different times of the year—in short, by ringing the changes as often and as widely as is practicable.

The Rural Engineer

A New Village Figure

DAVID C. THOMAS
Rural Industries Bureau

The Rural Industries Bureau is helping smiths to acquire new skills, new buildings and equipment to meet the needs of modern farm machinery.

SINCE the coming of mechanized farming, so much space and time have been taken up in writing about the decline of the local smith and his forge that hardly anyone has noticed the arrival of its successor, the modern village engineering workshop. Looked at with a conventional eye, this is not usually a picturesque affair; its attraction lies in its newness, its clean, square lines, and the excellent background which its chalky grey asbestos or concrete-panelled walls make for the spidery shapes and vivid colours of farm machinery.

The modernization of local workshops is of no small advantage to farmers, estate managers, woodland owners, and others whose work involves the use of more and more machinery. An efficient repair shop within a mile or two is an obvious asset, and often a better proposition than a private farm workshop—in which expensive plant is bound to be idle for many hours in the day. Moreover, the local shop will often work round the clock in an emergency, because of the personal relationship between staff and customers. Its charges are likely to be less than those of large town depots and agencies for many reasons—less has to be spent on transport and travel; rates, rent and overheads are likely to be lower; and items like advertising and travellers' salaries hardly trouble the country employer. To these advantages of cost can be added that of local knowledge of methods, soil conditions, etc., while a customer with valuable machinery will often be reassured to know exactly who is handling the job.

Technical education

Twenty years ago it would have been difficult to find a single village workshop ready to repair modern farm machinery, let alone diesel engines and hydraulic equipment. During the intervening years the work of raising the standard of technical knowledge and skill has been carried on by the Rural Industries Bureau, inconspicuously but extensively. In 1957–58, for example, the Bureau's staff of instructors made 3,758 visits to engineering shops. Also eleven independent courses of instruction on machinery overhaul were given at local centres, the subjects including the electrical installations and hydraulic gear of farm tractors and other special machinery.

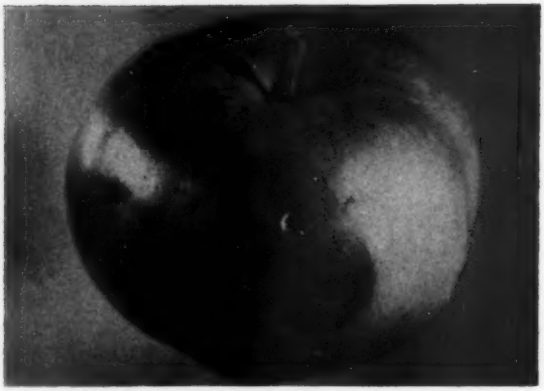
Improved skill, however, cannot be brought to bear effectively in decrepit, badly-lit buildings with earth floors, cramped approaches and insufficient overhead clearance. Here a remedy has been found in the creation of the Rural Industries Loan Fund, through which limited credit can come from

Photo: *Rural Industries Bureau*

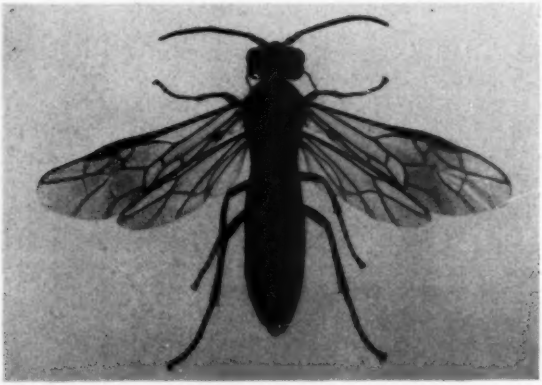
Men acquire new skills on a Rural Industries Bureau course.

Dock Sawfly (Article on pp. 402–5)

Dock sawfly caterpillar (X 5) feeding on a dock leaf—its usual food.



This apple has been bored by a caterpillar of the autumn generation, and subsequently invaded by two waves of brown rot.



Female of the dock sawfly (X 4).

Photos: *H. W. Miles*

Prepacking of Fresh Fruit and Vegetables (Article on pp. 384–7)

A modern prepacking plant.

Cauliflower is wrapped in transparent film. The raised arm is pulled down to heat-seal the pack.

A semi-automatic potato packing and weighing machine, suitable for use on a farm.

Photo: *Dairy Farmer*

Self-feeding in a Silo Barn (Article on pp. 379–83)

The silage clamp in this barn at Burnt Heath forms part of the yarding area for the cows kept under the same roof.

Treasury sources. So far it is available only to established firms, and loans are made only for buildings and equipment—not for working capital. The staff of the Rural Industries Bureau are often called upon to prepare layouts and drawings for these buildings, as well as for workshops rebuilt with other funds.

Equipment and machine tools have thus been progressively modernized to meet the needs of present-day farm machinery. Twenty years ago most village smithies could boast very little plant apart from their hearth, anvil and smith's tools, with the possible addition of a primitive drilling-machine and power hacksaw, belt-driven from a venerable gas or oil engine. Today very few workshops are without electric power, a sizeable modern drilling machine, arc and acetylene welding plant, shearing equipment and a wide range of powered hand tools. The more ambitious can rival, on a smaller scale, the machine shop of an up-to-date factory, and possess lathes, a milling machine, grinders, profiling machines, power guillotines, and in some cases specialized devices such as those used for calibrating diesel engines. Such machinery calls for more accurate and costly gauges and measuring tools than before; the capital equipment needed to run a modern engineer's workshop efficiently now goes far beyond what was thought adequate in 1939.

New accounting problems

Having acquired buildings and equipment on credit terms, the country engineer will probably need to raise his turnover to keep his machines running. For the same reason he will probably need extra staff; one- or two-man smiths' shops, once so plentiful and characteristic of English and Welsh rural trades, can hardly survive in their present form. This necessary expansion of staff, plant and turnover brings with it accounting problems undreamed of a generation ago. Here again the Rural Industries Bureau, with its staff of costing officers, has done much to help small firms keep track of their financial position among the mazes of taxation, time-sheets, mortgage payments, depreciation, insurance, rating assessments and occasional bad debts. Not the least of the country engineer's problems arises from the fact that his main customers, the farmers, often expect prolonged credit, while suppliers of raw materials and spares are not always so accommodating.

Unbroken tradition

Foreign as these matters would have been to the old generation of smiths, the basic job of the village engineer's shop does not vary much from that of the old smithy; farm transport, implements and motive power were, and still are, the main concern of both types of shop. Even in their secondary role as local centres for all types of miscellaneous engineering work, the old and new workshops have this in common: anything from a door-latch to a cracked chassis can still be taken for repair, usually by men well known to their customers in daily life—itself a powerful incentive to good service.

The silage clamp in this barn at Burnt Heath forms part of the yarding area for the cows kept under the same roof.

The London Dairy Show

21st—24th October

SYLVIA LAVERTON

THE bus going to Olympia was crowded. There was no mistaking its destination. Londoners on their way to work are seldom to be heard in animated conversation at nine o'clock in the morning. But this No. 73 bus fairly hummed with talk, as it carried its passengers down Park Lane and swung west at Hyde Park Corner.

For this was Tuesday, 21st October, the opening day of the London Dairy Show. Country men and women from many a farm and village were making their way to Olympia. And, as farmers and their wives are wont to do, they were talking shop, planning what to look at first, eagerly anticipating the pleasures of a day wich everyone knew would be packed full of interest, even though some no doubt suspected that it might be hard on the feet.

This suspicion was reinforced, on arrival, by the impressive size and scope of the show. In the 400-page catalogue, floor plans alone occupied no less than six pages. But the British farmer is never likely to be deterred by fear of fatigue when his interest is aroused. So new arrivals, after a preliminary glance round to orient themselves, plunged happily into the crowds, each in the direction of his or her prime interest.

There was something for everyone. Nowadays, the London Dairy Show is really several shows rolled into one, with floral arrangements, honey, preserves, pigeons, goats, pigs and poultry to supplement the central theme—dairying.

The major attraction remains, as always, the dairy cows. British Friesians once again headed the list of entries and six of them took the Bledisloe Trophy with 1,198·64 points. There were fewer Dairy Shorthorns, but more Jerseys than last year, and it was a famous Jersey, "Polperro", that won the Buckhurst Cup for the Jersey breed. For "Polperro", this was a hat-trick; she has now won three times running.

The pageantry of the Large Ring, and the more homely sight of cattle tethered in their new metal stalls at the far end of the hall are traditionally the heart of the Dairy Show. But milk is the raw material of one of our biggest industrial enterprises. It is right, therefore, that much space should be devoted not only to dairy products but also to the machinery and equipment necessary for manufacture and distribution.

It was heartening and also appetizing to see so much excellent produce displayed. There were nearly 4 tons of butter on show and nearly 27 tons of cheese—1,850 individual cheeses forming the highest number of entries for this class of produce since the war. Cream entries have trebled over the past three years.

This year, new features emphasized the industry's growing awareness of the consumer. Dairy ice-cream, sometimes referred to as "real ice-cream" but more accurately defined as "cream" ice-cream, was on sale as well as on

show. This important innovation received enthusiastic support from visitors as well as trade exhibitors. Among the ancillary trade stands, a lone Italian entry brought nostalgic memories of the Italian hokey-pokey man of childhood days, dispensing his delectable hand-made "cream ice-cream" personally from the hand barrow which he trundled down the village street. Today the demand for ice-cream is 100 million gallons a year, and it is still rising. The latest way of buying it is from coin-operated machines. Times change.

The other new section, for veal carcasses, was introduced to help encourage home veal production. The classes for pure-bred calves were well supported. Surprisingly, there were only two entries in the class for first-cross calves sired by a beef bull.

Much more revolutionary than introducing dairy ice-cream and veal to the Show was the decision to bring in live beef animals. But if our dairy herds are to help meet the need for home-produced beef, their appearance is logical. Visitors saw two live cross-bred beef steers from Scotland (by Scottish Shorthorn bulls out of Ayrshire cows) and were able to compare carcasses from the same cross-bred herd with those of other beef-dairy crosses and with pure-bred dual-purpose breeds.

When live bacon pigs were shown last year for the first time, they proved enormously popular; this year three times as many appeared. At the ringside, lively discussions developed on the relative merits of different breeds and systems of rearing.

Economic arguments were well to the fore on many stands. The pioneering work of the university agricultural economics departments, supplemented by the activities of the advisory services, official and commercial, is apparently beginning to convince a good many farmers that simple sums, based on sound accounting principles, are a more versatile and reliable method than rule of thumb for arriving at the profitability of different farming operations.

Demonstrations at the show providing thought-provoking figures included an exhibit of live pigs illustrating the economics of early weaning, data on the comparative costs of producing heavy pigs and baconers, and the Fatstock Marketing Corporation's display of live pigs alongside carcasses from the same litters, designed to answer the 64,000 question: what is the most economic feeding method to produce quality pigs? Three alternatives were on trial: rationed meal feeding, *ad lib.* feeding, and restricted meal feeding plus milk. Which proved best? As Professor Joad wisely used to maintain, it all depends . . .

This display was in fact the perfect illustration of one of the less obvious but very real functions of the Dairy Show—it provided stimulating food for thought and discussion during the winter evenings that lie ahead.

Dock Sawfly

An Occasional Pest of Apples

HERBERT W. MILES, D.SC.

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Although not one of the worst pests of apple orchards, dock sawfly can cause appreciable damage. Professor Miles discusses some ways of reducing the loss.

THE dock sawfly (*Ametastegia glabrata* Fall.) attracts attention in September and early October through the peculiar habit of its caterpillar of boring into mature apples at harvest time. Though the insect usually leaves the tunnel in a very short time, the injured fruit rots from the point of entry and is soon a complete loss. If the insect remained for any length of time in the tunnel, it would probably be drowned in the juices from the broken tissues.

The full story of this insect has not been told in Britain, though it has been a recurring source of loss in many orchards, and has been recorded from fruit-growing areas in Kent, East Anglia and Lincolnshire, the western counties, the Welsh borders and as far north as Cheshire and Lancashire. One of the earliest records can be credited to F. V. Theobald* of Wye, who mentions the occasional occurrence of "a second generation of apple sawfly" in September and reports receiving twigs of pruned apples with sawfly caterpillars tunnelling in the pith. Theobald's illustration of the caterpillar might well be that of dock sawfly, though he leaves it as an unidentified species. Injury by dock sawfly was subsequently reported from America and Russia.

Damage in Britain has perhaps been seen more frequently in recent years† and possibly attacks have been more severe. The fact that the attack comes long after spraying is finished, and when picking has begun, means that the grower can do little about it at the time. For this reason a better understanding of the life history of the insect and the circumstances of its occurrence is desirable, so that suitable control measures can be developed.

Life history

The dock sawfly may be seen in rough vegetation on headlands and waste places in late April and early May, when it is active in bright sunshine and flies readily. It is entirely dark coloured, having curious violet or coppery tints on the body, which is smooth and shining. The legs are reddish, and the wings are clear but have slight iridescence, pronounced veins and a dark mark or stigma on the fore-margin. The insect is slender and more delicately built than the apple sawfly *Hoplocampa testudinea* Klug. It is usually $\frac{3}{16}$-inch long, with a $\frac{1}{2}$-inch wing-spread, the males being slightly smaller.

* F. V. Theobald. Insect Pests of Fruit, 1909. Theobald, Wye.

† Notes on Some Interesting Insects Observed in 1954. A. M. Massee. *East Malling Res. Sta. Ann. Rep.*, 1954, 134.

Dock sawflies live for a week to a fortnight on nectar and honeydew. They then fly to dock, sorrel and plantain and related plants like fat-hen, persicaria and bishop weed, to lay their eggs. Each egg is inserted in a separate pocket cut in the leaf tissue by the saw-like ovipositor. A suitable leaf may have four or five eggs laid in it, but for the first two or three days the only sign will be slight swellings on the under-surface. A day or two later slight oval swellings will be seen on the upper surface of the leaf. When removed from the leaf, the eggs can be seen to be about 0·8 mm long and translucent white.

In about ten days the eggs hatch, and produce caterpillars with almost colourless bodies and smoky heads. These caterillars feed by biting at the lower surface of the leaf, and the first meal shows as a green thread through the middle of the nearly transparent body. At first, the upper surface is too tough for the young caterpillars, but after a few days they can eat holes through the leaf, and then they curve their bodies along the broken edges as they feed. They seldom migrate to the edges of the leaves to feed, but bite into a new leaf from below and then enlarge the feeding holes, until stopped by the stouter veins. The young caterpillars cling firmly to the leaves, but from the time they are about $\frac{1}{4}$-inch long they will fall to the ground at the least touch, lying closely curled on the soil for several minutes, before climbing back up on to the plant. It is this habit and their leaf-green colour that makes dock sawfly caterpillars so difficult to find, even in an orchard where they are plentiful.

As they grow, the caterpillars shed their skins four times at 3-4 day intervals, and after 16 or 17 days they are fully grown and about $\frac{3}{4}$-inch long. At this time the caterpillar has a pale yellow head and black eyes, finely wrinkled body of a bluish-green or dark grass-green colour, three pairs of stout, pale, true legs on the three segments immediately behind the head, and short, pale prolegs on segments 5–11 and 13.

When fully grown the caterpillars stop feeding, void the stomach contents, turn a brighter green and then leave their food plants and crawl away in search of places in which to become chrysalids. The dock sawfly caterpillar does not spin a cocoon in the soil, it burrows into pithy stems, dead twigs, holes in branches or posts, dead bark, in fact into any softish corky or pithy material. In this it bites a tunnel nearly an inch long, throwing out the "sawdust" behind it. Then it turns round and seals the entrance hole with parchment-like material, in which some of the fragments may be caught. These stopped holes are almost circular and about $\frac{1}{12}$-inch in diameter; they are not easy to find, as they soon take on the colour of their surroundings.

Within its pupal chamber the caterpillar shrinks, becomes more deeply wrinkled and, after 8-10 days in summer, sheds its skin and becomes a pale green soft chrysalid. Gradually the head and body darkens and then the limbs, and in about eight days the sawfly, now fully winged, is mature and ready to bite its way out through the sealed entrance hole.

The life cycle from egg to adult takes about 45 days, and can be repeated at any rate twice during the summer. The second generation caterpillars are mature by late July and the third in September. It is the third generation that causes loss to the fruit growers. The autumn caterpillars wander far in search of pupation sites and often try several places before being satisfied. The chambers formed in autumn have to serve the insects for

hibernation as well as pupation, and are occupied from October until April or May. Many of the caterpillars crawl up into trees in search of old bark and dead pithy stems; others enter the tough stems of dock and other herbaceous perennial plants. It is some of the caterpillars searching trees that burrow into the apples in an attempt to hibernate in them.

Practical considerations

The dock sawfly is likely to occur in any fruit plantations where dock, sorrel and plantain grow. These plants, particularly the docks, are found as weeds to a greater or less extent in all plantations, and in attacking them the insects must be regarded as useful.

When orchards are put down to grass and gang-mown regularly, dock, sorrel and plantain may resist the mower for a time and survive in the sward, but the docks will grow increasingly in the trunk squares, where the gang-mower does not reach and where it is difficult and costly to cut by hand-mower, scythe or hook. These conditions result in a steadily increasing food supply for the insects and therefore the dock sawfly multiplies.

Though the number of dock plants in an orchard may not seem great, it is surprising how many occur even in a moderately well-kept plantation. A winter inspection of 257 trees in a Kent orchard between twenty and thirty years old, showed a total of 240 well-established dock plants, within a three-foot radius of the trunks. These plants had an average of four to five old flowering stems per plant. About 8 per cent of these hard, dry stems contained the hibernating caterpillars of the dock sawfly, and one plant (with a total of 18 stems) contained 6 caterpillars. However, in a sample of 35 hibernating caterpillars in their winter chambers in the stem, 21 proved to be infested or destroyed by parasites that then occupied the sawfly chambers. This suggests that any control applied in winter might easily kill more parasites than sawflies.

Information of this kind is important, for it means that any wholesale cutting and burning of the docks that did not kill the rootstocks would destroy, chiefly, the parasitic insects that help to keep dock sawfly in check. Obviously, if the task is not too costly and the labour is available, digging out the docks and leaving them with the mulch to die under the trees would be sensible practice. This would eliminate the docks and allow the parasites to escape and should be followed by an appreciable reduction in dock sawfly damage.

Similarly, if there is any cutting of the rough vegetation in summer and autumn, the rough material should be left to provide hibernating sites for the dock sawflies and so discourage them from climbing the trees.

Grease-banding the tree trunks in early September has already been tried in some Kentish orchards, but its success is difficult to assess. The problem of dock sawfly is not insoluble; short of eliminating the docks entirely, which is undoubtedly sound practice, it seems likely to be solved by practical means not necessarily involving the application of more insecticides in an already costly and overloaded spray programme.

Forking out when weather and soil conditions are suitable should not be too costly by today's standards, with trees grassed down within 8-10 years on reasonably clean land. A moderate infestation—that is, 0-30 dock plants

per tree—should not cost more than 4*d*. per tree to fork out, and with dessert fruit it needs the saving of only three or four apples per tree to recover the cost. The reward in clean fruit may well prove much greater than this. The advocates of better orchard hygiene will hardly find a more apt subject for demonstration than dock sawfly control, for removal of the weed hosts will certainly be followed by the elimination of an annoying and preventable loss.

N.A.A.S. Experimental Husbandry Farms

Great House

C. H. MUDD, B.SC.
Farm Director

AGRICULTURE on the Pennine Chain has all the usual features of hill farming—poor thin soils, rocky outcrops, high rainfall, steep slopes, lack of shelter and so forth. Much of the area is devoted to hill sheep and the rearing of store cattle, but there is a very large area—over half a million acres—in the central Pennines where the farming has developed to supply food for the nearby industrial population of some five millions. Most of the farms are small, not more than 30–40 acres, and heavily stocked with dairy cows, pigs and poultry. There is little arable land, and the occupiers have always relied on heavy imports of feedingstuffs.

In addition to these natural hazards, there is the great handicap of a highly polluted atmosphere. Sulphur dioxide poisons plant life; production from grasses is reduced by nearly one-third, and many of the sown species are killed in winter. The smoke haze also reduces the intensity of sunlight, and this in turn has a bad effect on both plants and animals.

Typical difficult conditions

Great House, in Rossendale, is typical of the worst of the Pennine conditions. It was established in 1951, when two farms of 100 and 250 acres were bought. At one time, there were no less than fourteen separate holdings on this area of land which rises steeply on both sides of a tributary of the river Irwell. The lowest point is 700 feet above sea level and the highest 1,200, whilst the adjoining moor on which the farm has grazing rights for sheep rises to nearly 1,400 feet. The tenancy of Buckden Farm, 90 acres of similar land a mile from the main holding, was acquired in 1957. The average rainfall over the past six years is 61 inches, and the average number of days on which rain was recorded 269. Records of atmospheric pollution show the amount of sulphur dioxide and smoke in suspension to be greater than that found in the centre of many large towns. About 5 cwt of soot is deposited on every acre of land each year.

This part of England was heavily glaciated during the ice-age, and in consequence the soils are very varied. Great House is no exception: soil scientists have recorded fifteen separate soil types, but in the main there is shallow boulder clay overlying shale and rock. Drainage is impeded and practically all the land has to be drained artificially, a very heavy capital expenditure in view of the limited returns. The high rainfall, combined with the acidity of the soil, demands heavy and frequent liming. The potash status is moderate, but the mown fields have become low in potash (there is a lack of straw to soak up liquid manure from cattle in sheds). The heavy feeding of concentrates over the past hundred years has raised the status of phosphate on fields which are regularly mucked. All pastures, on the other hand, are low in phosphates.

Naturally, most of the problems under investigation at Great House are associated with hill farming conditions. The size of the holding has been criticized as not being typical of the majority in the Pennines; but to obtain scientific accuracy it is essential to replicate experiments, and this calls for large areas of land and considerable numbers of livestock. Wherever possible, however, the small farmer's tools and equipment are used to do the normal work of the farm. Light, wheeled tractors and machines are used exclusively, and we have made our own grass drier. Buildings are designed to provide accurate experimental results without subjecting the stock to anything other than normal farm conditions. We have generally had to adapt existing buildings rather than build new; two old shippons have been converted into loose boxes with individual feeding arrangements for young stock, and a stable and barn have been made into shippons. A large house has been divided to provide offices, laboratory, library and two houses. New buildings comprise a piggery, tractor shed, workshop, bull box and a pair of cottages. The stock themselves have been selected as typical commercial animals, the breeds being those found in the area—Ayrshire cattle, Derbyshire Gritstone sheep, Large White pigs and cross-bred poultry.

Grassland problems

Experiments naturally centre on the production of food for stock and their feeding and management. The manuring and management of grassland has first call on our attention, since the growing of cereals, roots and forage crops is limited. In recent years much emphasis has been placed on the desirability of ploughing up old pastures for cropping and reseeding, and this policy was adopted on many Pennine farms. Only on a minority, however, has it been kept up, although the cost of purchased feedingstuffs has remained high. The reversion to a system of all-grass farming with permanent swards is due to the difficulty of maintaining a productive temporary grass for more than a year or two, and to the high cost of cultivations. Investigations at Great House are designed to find out just how much more productive the sown grasses are in comparison with indigenous species (and present indications are not very encouraging), and what species and strains are best for local conditions. There is little real evidence on the best dressings of fertilizers and lime, or on when and how often these should be applied under Pennine conditions; long-term field experiments are in progress to find the answers to these problems, using perennial plants such as grasses

and clovers. Long-term effects are important, and various management treatments have been laid down in addition to manuring, so that any variation can be observed and measured. For instance, what is the effect of grazing enclosed land heavily by lambing ewes in the spring, as is done on all hill sheep farms? Can the ill-effects be mitigated by additional fertilizer or a rest in the previous autumn?

Wintering cattle

The conservation of grass for winter feeding is being studied. A home-made grass drier which can also be used for barn hay drying with cold or warm air has already been mentioned. It is helping to compare the costs of grass drying and silage-making and to investigate the possibilities of barn hay drying, either with cold air or with an initial drying with cold air, finishing off with heat. The latter system is being compared with more conventional haymaking methods: the finished products are tested by feeding trials whenever possible. Permanent grass must always form a very important part of all upland farming schemes, and its management and manuring to increase quality and productivity are being investigated. The control of grassland weeds by sprays is an important part of this work. Of the arable crops, only oat varieties suitable for hill conditions are under trial.

One of the greatest problems of the livestock industry in this country is to devise a system of feeding which will give an economic return. This is doubly important to the small hill farmer who must maintain his turnover, for lower costs of production must not involve a lower output, and to the producer-retailer. It must be borne in mind when studying the results of feeding trials.

Most dairy cows and bulls have been selected for many years on the ability of their dams to produce large quantities of high quality milk. Little or no account has been taken of the methods adopted in obtaining this milk, and it has been the practice of most bull breeders to feed large quantities of concentrates to their cows in order to obtain high records on which the bulls are sold. To reverse the process and breed bulls from cows which have the capacity to produce milk from cheap roughages would be a long job, but it might be possible to train animals to eat greater quantities of home-produced roughages. This is being attempted at Great House, where heifer calves born in the autumn are divided into two groups, one being reared in the normal way, while the animals in the second receive no concentrates from the age of six months until they calve, but are encouraged to eat as much hay and silage in winter as they will take. When they come into milk, the bulk-reared heifers are on the whole rather lighter, but their capacity for eating bulk foods is greater. Milk production is about the same for both groups. As second calvers, the bulk-reared group maintain their capacity for eating roughage, but this difference may diminish in later lactations. These animals will all be kept throughout their useful life, to see whether there are any long-term effects of this system of rearing.

Although silage feeding to dairy cows is now common, it is rare to find farmers practising the recommended method of feeding concentrates for production—that is to say, after the first two gallons have been produced from silage. In one experiment we fed an all-concentrate production ration rather than one using only grass silage for the first two gallons; this invari-

ably resulted in less and poorer milk from the high-protein silage. A third production ration, comparing half silage and half concentrates fed for all milk produced, gave results comparable with an all-concentrate diet. The concentrate fed with silage was later changed to a cereal or other starchy food and gave similar results, indicating a deficiency of soluble carbohydrate in the silage. Feeding silage balanced with a starchy food to dairy cows is now generally recommended.

The rearing of calves has received some attention in recent years, and methods of replacing the milk by milk substitutes have been compared. Rations composed largely of dried skim milk have been used successfully, and compare favourably with whole milk diets up to twelve weeks. Early weaning at three weeks has also been compared with bucket feeding with whole milk; again, both diets give satisfactory liveweight gains. Systems of turning out calves to grass in the spring have been tried to overcome the check usually experienced. The most satisfactory method appears to be that of turning out the calves during the day before growth commences but continuing to give winter rations until the grass comes away.

Home-wintering of lambs

The most pressing problem of the hill sheep farmer today is the cost of wintering his ewe lambs on lowland pastures. All the sheep at Great House have been devoted to an experiment on this problem. Several ways of overwintering the lambs at home have been tried on a small scale—including running gimmer lambs on the in-land with access to hay; similar treatment, but giving silage instead of hay; feeding both hay and silage; wintering on foggage; and housing the hoggs and feeding on hay.

The first method seems the most satisfactory, and each year the lambs are divided into two groups, one being sent to a lowland farm and the other allowed to run on the in-land, with access to hay in an out-barn. In the spring both groups run together on the moor, and all receive identical treatment from then on. The ewes are treated as a true hill flock until the fourth lamb crop, when they are confined to the enclosed land and crossed with a Wensleydale tup, then sold the following summer. From records so far, home-wintering results in a considerable saving in cost and does little or no harm to the ewe or its offspring. We can generally dispose of about half the wether lambs in a finished condition. Implantation of hexoestrol has been tried on some fattening lambs at weaning, leaving a similar group as controls. Results to date appear to be promising: the implanted lambs have made greater liveweight gains and higher profits than the controls, and carcass inspection has revealed no major differences between the two groups.

Poultry and pigs

Poultry have always been very important in Lancashire and the West Riding of Yorkshire, and intensive systems of poultry-keeping are becoming more popular. With assistance from Conditional Aid Funds, a poultry unit was established in 1954, to rear and house about two thousand birds. The effect of environment on egg production is being studied, and we are experimenting on the feeding of growing pullets. The establishment of a pig unit

this year completed the livestock development of the farm. The Large White herd of twenty-five breeding sows will be used for feeding and management experiments; facilities are available for individual feeding.

During the summer months, the cutting, weighing and sampling of grass plots involves 1,100 cuts. Dry matter content is determined on the farm, whilst crude protein, phosphate and calcium analyses are carried out at the N.A.A.S. Regional headquarters. Complete records of food eaten, production, liveweight change and milk analyses, together with individual feeding for 160 cattle, 200 sheep, 2,000 poultry and 300 pigs, calls for extreme care seven days a week throughout the year. The fact that the task is accomplished successfully reflects great credit on the conscientious and hard-working staff on the farm, in the office and at the laboratory bench.

In conclusion, I wish to record my appreciation of the advice and assistance given by members of the Farm Advisory Committee, who have done so much to keep the development of the farm on the right lines.

Some Thoughts on Agricultural Credit

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Mr. Jawetz examines the various sources of credit available to farmers and concludes that although some farmers are not making the best use of the credit facilities already available, there is, nevertheless, a need for additional facilities for medium-term credit.

DURING the period of the credit squeeze, bank advances to agriculture fell slightly in absolute terms, but they remained practically constant when taken as a proportion of total bank advances. The decrease was probably due mainly to a reduction in the long-term credit provided by the banks. Until very recently it was difficult to get a bank overdraft to buy a farm, and not easy to get a loan from the bank to build or improve a farm building. Nor was it always possible during the credit restrictions to borrow on long term from the building societies, so that an increasing number of farmers had to turn to the Agricultural Mortgage Corporation and other Government mortgage organizations, or to private sources, for their long-term credit.

Apart from the fact that a certain scarcity of long-term money had a depressing effect on the price of farms, it was bound also to limit the use of the improvement grants of one-third of the cost by those farmers who needed them most. They may have found it hard to borrow any or all of the remainder. It will be interesting to see to what extent the long-term credit institutions have been able and willing to provide the capital to match that provided by the State. Wales, with her many marginal farms, might in this respect have fared relatively worse than England.

Hire-purchase

There has been no indication of any restrictions by banks on credit for periods up to about three years, barring those normally observed in banking practice. On the contrary, many farmers who could borrow money for machinery from their banks are reluctant to do so. They prefer hire-purchase terms regardless of their higher costs. However, many of the smaller farmers may in future make use of the Personal Loans Schemes offered by the banks, which give more favourable terms than most hire-purchase can offer.

But the growth of hire-purchase credit since the war satisfies a demand by those farmers who are too short of capital, or too bad a credit risk, to obtain all they need from banks. In many cases hire-purchase permits such farmers to use their limited bank credit for more urgent purposes. To take a pessimistic view: if hire-purchase instalments cannot be met, the piece of machinery in question will quietly return to the dealer, whereas bailiffs have a known predilection for livestock. The farmer who has not enough cash to buy an implement, but does not anticipate any need for more credit until that implement is paid for, can acquire it with an overdraft at a cost several times less than through hire-purchase. If he does not, the reasons are not economic but psychological. Hire-purchase comes to him, while he has to go to the bank; the former tends to be negotiated in an atmosphere of a buyer's market, but the banks always operate in a seller's market.

Whereas the 50 per cent deposit required for plant and machinery until 29th May 1957 was too high, and genuinely hampered many a farmer's endeavour to increase efficiency, the 33⅓ per cent deposit required until 5th September 1958 (when most hire-purchase agreements in agricultural equipment were freed from control) seemed reasonable. It may be doubtful whether it would be financially wise for a farmer to buy machinery with less cash and on a longer period of repayment than the 24-months maximum prescribed by the Hire Purchase and Credits Sales Agreements (Control) Order, 1938, which has been modified recently. At present no minimum cash payment and no maximum period of repayment is required by law on most items.

Purchases of livestock were exempt from the provisions of the above (Control) Order in any case. As yet hire-purchase transactions in livestock are not very common; but, if the cold wind blowing through agriculture continues, an increasing number of farmers (particularly smaller ones) will be forced to intensify their operations, and the demand for medium-term credit will increase. Those farmers who are financially weakest may have to resort to hire-purchase, in order to obtain additional dairy cows, for example. They had better remember that the annual return over purchased concentrates of a milch cow is roughly equal to the purchase price of the animal; if the price is to be repaid in one year, not only will there be no contribution from the new animal to the economy of the farm, but extra outlay will have to be incurred, at least on concentrates. The net addition to profit will be felt only in the second year. If the extra outlay cannot be borne from existing resources, the period of hire-purchase should if possible be extended over 18–24 months, or it may be safer to abandon the scheme altogether.

Trade credit

The credit squeeze did not make it more difficult for producers to obtain trade credit. But it made it more expensive, and *shortened* the periods for which it used to be extended. Whereas a few years ago it may not have been easy for a farmer to induce his feed and fertilizer merchants to send him a bill once in six months or even longer, at present failure to pay the bill within a month or two will generally stop further deliveries of concentrates, while three months tends to be the normal limit of credit for fertilizers, at least with co-operatives.

In one respect the tightening of trade credit could have been advantageous with the possibility of a relative lowering of retail prices of production factors. The agricultural merchant has to consider the time-lag between delivery and payment in calculating his prices (which therefore tend to be geared to the slow-paying customer). As a result, the prospective cash buyer, or the man willing to pay in 30 or 60 days, had in the past to pay prices conditioned by the majority of customers who only paid several months after delivery, though a large proportion of the latter may have had sufficient money lying idle to settle their accounts sooner. This system benefited only farmers who, being short of capital, could turn over that part of the receipts from their production which would eventually return to the merchant, before they paid their bills. This category of farmers, some of whom have stretched to the limit their capacity for bank loans, had been badly hit by the credit squeeze.

Those producers who used to finance the fattening of pigs or the provision of fertilizers through merchant's credit should be able to obtain bank accommodation for these operations. Once they have found out that such credit is cheaper than open accounts with the dealers, they may never revert to the old system.

Does borrowing cost too much?

In view of the relatively high interest rates prevailing at present, some farmers express doubt as to whether it is advisable to borrow at all. As far as short- and medium-term credit is concerned it can be taken that, where it would be profitable to borrow at a low interest rate, it would still pay to do so at a higher rate. In agricultural production the margin between variable costs and returns is relatively wide, and a higher interest rate can only insignificantly narrow the net return on the process. This seems to be understood by those farmers who make use of bank credit, since there is no indication that even the 6 per cent interest rate has deterred them from such borrowing. The position is more complicated in the case of long-term credit. When it is required for the purchase of a farm, it would be very risky to buy one at *an inflated price* at a high interest rate that would remain high even in the event of deflation. But it is one of the paradoxes of our creeping inflation that from the moment of its first major crisis—the devaluation of the pound—values of vacant farms first became stabilized and later, for a few years, even showed a slight tendency to fall. Values of tenanted farms are influenced by the prevailing rates of interest in any case. Finally, values of both vacant and tenanted farms tend to be lowered by a credit squeeze in so far as it affects the new landowners and farmers from industry, commerce and the Stock

Exchange. In view of this it may be good business to pay even a high interest rate on mortgage on a *cheaply bought farm*.

Where long-term credit is needed for an investment improvement essential for an increase in the profit-making capacity of a farm, a high interest rate should not deter the borrower, even if he is a tenant. Labour-saving installations or buildings would fall into this category only if it were hired labour, and not the farmer's own, that could be saved; increased convenience or leisure, desirable as they are, can be expensive luxuries at 6 per cent interest! So are improvements which can "increase" the farm's value but not its profit.

Marginal farmers

From these comments one might conclude that sufficient agricultural credit is available in this country to meet all the "reasonable" demands for short-term, and most of those for long-term, credit, while medium-term credit is more difficult to obtain owing to a gap in the existing arrangements for providing loan capital. But this is true only for the present state of farming practice and efficiency. It is well known that many farmers do not farm as efficiently as would be desirable in their own and the country's interest. Some may be too old to change their ways; others may lack the knowledge and initiative to better themselves. But it can be taken that a proportion of these "marginal" and low-profit farmers have both the knowledge and the will to become economic, but have been seriously hampered by lack of tenant's capital, a condition which is often aggravated by their landlord's lack of capital for improvements. (Wales, with such a large proportion of smaller farms, probably has a relatively greater number of farmers in this category than England.) Such farmers never had much chance of raising medium-term money from banks and, as an aftermath of the recent credit squeeze, even that chance may have vanished. Here, amidst full employment and an economy which has long been buoyant (though on an inflated basis), is a section of the agricultural industry whose productivity could be increased to an economic level if assistance were given where it is most needed. Suggestions for creating a specialist agricultural credit institution which could guarantee medium-term loans for production investment have been made from time to time, but it is doubtful if these have taken forms likely to be acceptable to the Government. This is unfortunate, since it is probable that the losses incurred through such "bad" loans would be more than offset by the gain to the nation from the increased productivity of most would-be borrowers.

Farming Cameo: Series 2

8. North Carmarthenshire

W. A. MAXWELL, D.F.C., B.SC.
District Advisory Officer

NORTH CARMARTHENSHIRE lies between the rivers Teify in the north from Cenarth to Llanybyther, and Towy in the south from Carmarthen to Nantgaredig. The land rises from the alluvial valleys of these two picturesque rivers to marginal uplands, and is rugged and naturally barren in the north-east. The soils of the district as a whole are of local drift materials from Ordovician and Silurian shales.

Dairying is the principal enterprise of the valley holdings, but many of the larger also carry a small sheep flock, and some farmers buy store bullocks from local upland areas for fattening during summer and autumn. The rivers cause occasional distress to valley farmers but, that apart, they are famous for salmon fishing.

The rough land of the north-east lends itself more to sheep and livestock rearing, though the more easily accessible holdings sell small quantities of milk. Two large areas of common grazing in this region, 1,300 feet above sea-level, provide summer and autumn grazing for holdings round the margins of the moors. Hardy Welsh Mountain ewes, having lambed on in-bye land, are moved up to the commons along with store cattle from mid-May. Paradoxically, Welsh Black cattle, which are most suited to these conditions, are almost entirely absent. It is the Shorthorn breed which is predominant. The main crops are rape and oats, the latter harvested slightly green and fed in the sheaf to supplement hay.

The Forestry Commission have approximately 12,500 acres of this region in plantations of various ages and sizes, this again reflecting the inherent fertility of the area.

The remainder of the district, stretching west to the Pembrokeshire border, rises in places to 1,000 feet and is intersected by wooded valleys and the main highways which converge on Carmarthen. The majority of the 1,169 registered milk producers are in this area. The rotations on the larger holdings are pivoted on long leys, with oats, roots and kale occupying the tillage break. "Early bite" is produced mainly from long ryegrass leys, though some farmers sow temporary leys or rye for this purpose. Small holdings invariably eliminate corn from their rotation, kale being the only tillage crop. After war-time restrictions the tillage area was drastically reduced and a large acreage went back to permanent grassland.

Heather moorland is a common sight in the district, and many areas of previously unproductive virgin land are now lush, green pastures. Today the cost of reclamation is high, and maintenance with liberal doses of lime and fertilizers is expensive, to say nothing of the further capital required for additional grazing stock. Since 1954, a less costly, but no less spectacular,

method of reclamation has been under investigation. An area of moorland has been reclaimed by applying lime, fertilizers and cheap seed cleanings direct to the surface of the land without any cultivations. Every year the plots receive varying applications of fertilizer: production from them compares favourably with the other method, and the gradual increase followed by a corresponding increase in stock lays less strain on the capital resources of small, marginal holdings.

The average annual rainfall is 63 inches, of which 14–16 inches fall in June, July and August, invariably reducing the quality of hay. Silage-makers are increasing, but there are still too few, despite the Silo Subsidy Scheme.

The excessive rainfall and consequent quick growth of annual weeds are detrimental to many broadcast crops of kale, and are discouraging kale growers. The effective control by modern safe, selective weed-killers of many annual weeds could increase the importance of this crop.

Despite a 25 per cent reduction in the labour force during the last ten years, farm production has increased. This achievement has resulted from heavy capital expenditure on machinery, and longer working hours by family labour. Lately the trend has been to reduce drudgery, and there has been a crop of ideas for loose housing, self-feeding silage, and milking parlours. The increase in loose housing and the smaller acreage of corn has given us a bedding problem: one solution may be the use by contractors of a portable machine to convert the plentiful supply of timber on holdings into woodshavings as a straw substitute. However, despite this obstacle many silos are designed to facilitate self-feeding, either *ad lib.* in conjunction with loose housing, or by turning stock from the cowshed for a limited period.

After the war a number of immigrants, most of them Polish, took poor holdings with little capital. Many failed, but the more progressive are now well established, and in some instances assisting many local farmers to break with the older traditional methods.

There is no heavy industry; the light industries present are connected with wool and milk. Of the fifty or so woollen mills in Wales, at least thirteen are on the banks of streams and rivers in North Carmarthenshire, their size varying from the family mill to the largest employing fifty or so workers. Electricity or engine power is used to spin and weave tweeds, blankets, and quilts. Many of the smaller mills were run in conjunction with small farms, but most of them, failing to compete with the larger and better-mechanized mills, have closed.

Three milk factories, two in Carmarthen, the other at Newcastle Emlyn on the Cardiganshire border, serve the district. Their records show the solids-not-fat problem to be less serious than in many of the more fertile areas of the county.

Finally, the area is notable for its scenery, for salmon fishing with coracles on parts of the rivers Teify and Towy, and for its connections with the nationally famous Welsh Bard, Elvet Lewis, who died in 1953 at the age of ninety-three. This famous preacher, poet and hymn-writer was brought up on his parents' farm overlooking the village of Blaenycoed.

At the Farmers' Club

Labour Aiding in Practice

"I CONSIDER that manpower is the weakest and most expensive form of power on the farm," said Richard Wellesley, M.C., D.L., opening this season's session of meetings at the Farmers' Club on 8th October. "I believe, therefore, that we must think hard how not to use man's muscles." He spoke from personal experience of the value of the self-unloading trailer which he has been using, very successfully, on his own farm for over a year.

The machine has a floor very much like a manure spreader, which moves the load forward. Two beater bars at the front, revolving like those of a muck spreader but much more slowly, help to tease out the load, which drops "like a waterfall" on to a rubber conveyor belt below and so to the trailer. The machine, which requires very little power, is driven by the p.t.o. of a tractor or lorry, and its cost should not be more than that of a manure spreader. It will deal with grain, chopped green fodder, hay or straw, even sugar beet—in fact anything chopped or in the nature of separate units.

As an example, Mr. Wellesley described how his self-unloading trailer delivers its 3-ton load of cut, chopped grass into the dairy cows' manger in ten minutes. This is half the daily ration of grass for 90 cows. A mixed ration can be delivered automatically if grain is spread on top of the grass before unloading. For silage-making, the chopped grass is blown from the trailer direct into a nine-bay Dutch barn from each end, metabisulphite being added at the blower.

The attractive possibilities of the self-unloading principle, allied to zero grazing, were impressed on Mr. Wellesley by the sight of 18,000 beef animals being fed all the food they required by four men—4,500 animals per man. These fortunate fellows did the job in comfort, driving their self-unloading lorries quite fast, while listening to the radio and smoking cigars. This was in the United States!

Though manual work in grain handling has been largely cut out, grass handling is still largely a muscular job and silage-making continues to be very hard work on many farms. With the aid of three self-unloading lorries, Mr. Wellesley is hoping to remedy this on his own farm.

Together with his partner, Major John Fletcher, he has been practising zero grazing for dairy cows since May 1957, using a powerful cutter chopper loader with a maximum throughput of 48 tons an hour and two self-unloading trailers.* The cows are fed twice a day from long mangers which provide 2½ feet per cow. The driveway is designed to allow unloading in a straight line, an essential feature when handling grass mechanically. The object is to get the greatest profit from milk.

Zero grazing enables the grass to be treated as the valuable crop it is. Maximum benefit can be obtained from all the fields on the farm by taking the rotation right round instead of being forced to keep grass close to the buildings for the benefit of the cows.

* See Zero Grazing on a Berkshire Farm. *Agriculture*, 1958, **65**, 332–4.

"We have definitely decided," declared Mr. Wellesley, "that grass management is much easier by cutting regularly than by grazing—either by strip or block or any other method. The grass for feed or silage is cut to 3 inches when it is 9 inches tall. We are quite confident that by cutting the grass at this stage we are going to get more and better grass and clover-rich leys and, probably, keep the leys much longer."

Zero grazing eliminates selective grazing, otherwise a great problem for the second and third grazing. There are no muddy gateways, cow pats or cow tracks. The stock is contented and, since the animals have been in the yards, their feet have improved. They no longer spend time hiking.

Changes of food can be made very gradually, particularly, for instance, when introducing spring grass. This spring, good milk increases were obtained without scour by feeding 20 lb per cow of young grass grown in a field two miles away. The danger of bloat, which can be serious, can be overcome when a self-loading trailer is used, by blowing in chopped hay or straw and mixing it with the grass when unloading. With zero grazing, the cows' rations can be controlled to a fine degree; and rolled oats, minerals, and other food are easily mixed in.

With the cows under the cowman's eye all the time, casualties can be reduced and management improved. The vets have been so pleased with the results, said the speaker, that they have suggested keeping in all the young stock too, but he added, "we haven't got to that stage yet".

Mr. Wellesley then emphasized that adequate machinery is absolutely essential. "It must be good machinery, suitable for the task and capable of harvesting the grass and bringing it in and unloading it under all weather conditions, no matter how wet. The men operating the machinery must have the mechanical ability, and of course the job has to be done seven days a week." Buildings must also be really suitable, including a properly ventilated shelter for the cows and a loafing area of scraped concrete.

Among its disadvantages, zero grazing involves the need for more straw. It also extends the manure problem. Mr. Wellesley mastered this by the invention of a scraper that quickly pushes the sloppy manure from the concrete along the yard, up a ramp and into a trailer, for tipping or spreading. Straw and manure need be removed from the bedded area only once or twice a year, provided it is adequate.

So far, Mr. Wellesley and his partner have found that the advantages of zero grazing outweigh its disadvantages, and they consider that the underlying principles of mechanical handling could find many other valuable applications on the farm. Possibilities include moving chopped hay into the barn for drying and delivering chopped straw direct to the bedding area for stock; mixing and delivering bulk fertilizer to the distributor in the field; moving potatoes from the digger into store and sugar beet from the harvester to stack or into trucks; loading grain direct to elevators; and filling troughs or self-feed hoppers with pig and poultry food.

Unloading from the rear, an alternative to side-unloading, is sometimes advantageous, and the mechanism is cheaper besides being easy to fit to any lorry or trailer.

Summing up, Mr. Wellesley reaffirmed that the self-unloading principle really does aid labour with many farm tasks. He added, "I wish a *British* manufacturer would produce one".

Sylvia Laverton

In Brief

NEW ZEALAND COMMENT ON BRITISH MILK PRODUCTION

Dr. C. P. McMeekan, Superintendent of the New Zealand Department of Agriculture's Ruakura Animal Research Station, has warned New Zealand dairy farmers that the British milk producer has for the first time in history become an effective competitor. British farmers who before the war produced 1¼ thousand million gallons of milk, are now producing nearly 2¼ thousand million gallons. Of the first figure, 400 million gallons went to manufacture; now over 700 million gallons are being so used. New Zealand manufactures only about 1,000 million gallons of milk a year.

Speaking at this year's Ruakura Farmers' Conference, Dr. McMeekan went on to say: "Most dramatic of all changes is the rediscovery by British farmers that milk can be produced from grass. I am not being facetious. Pre-war a large proportion of British farmers had developed the habit of producing milk from cheap imported foodstuffs obtainable so easily by the mere use of a telephone and a cheque book. War-time pressures forced a virtual revolution in British farming as a whole and particularly in respect to grass production and use. Today most of the milk of the United Kingdom comes from grass and grass products.

"The general idea now is that pasture can provide maintenance plus two gallons of milk per cow per day, so that concentrates are fed only when yields above this level are sought."

But of our milking methods, Dr. McMeekan said: "Though outstandingly better than years ago, when most cows were milked by hand, British machine milking still has a long way to go, and in particular still uses far too much labour. Undoubtedly, milking techniques can and will be streamlined in future. Better machines, the introduction of circulation cleaning, the development of automatic recording of individual cow yields, and the use of releaser plants will alter the level of milking efficiency in the not too distant future with consequent effects on costs. Farm labour at 30s. a week twenty years ago could be ineffectually used without great harm to production costs; farm labour today at 150s. a week must be used efficiently. Labour is estimated to account for nearly a third of all dairying costs. British farmers are fully aware that they can reduce costs in many directions, particularly by better use of their labour force."

VIRUS YELLOWS AND SUGAR BEET

The suspicion that more than one virus can cause yellowing and embrittlement in sugar beet leaves, first aroused by work at Rothamsted in 1953, has apparently now been confirmed. From infected leaves, collected between 1955 and 1957 from farms growing sugar beet commercially in East Anglia, scientists at the Cambridge Plant Breeding Institute have succeeded in transmitting, through aphids, two distinct viruses to sugar beet plants. On test seedlings, one produced both yellowing and vein-etch, the other only yellowing. The former, tested serologically, proved to be the well-known "virus yellows". The latter, which was different serologically, and also under the electron microscope, has been called for convenience "sugar beet milk yellowing virus".

Its effect on yield of roots in infected sugar beet belies its name; its mildness seems to be confined to its visual symptoms. In glasshouse experiments, plants inoculated with the "mild" virus suffered as big a decrease in the weight of washed topped roots as plants inoculated with a moderately severe strain of the "ordinary" virus. Since the two viruses seem to be unrelated, varieties of sugar

beet bred for tolerance of one may not tolerate the other. It may therefore be necessary to start an additional breeding programme to counter this newly-identified virus disease. The 1955-57 survey showed that it is both widespread and common in field crops. A preliminary report by Dr. G. E. Russell is given in *Annals of Applied Biology*, September, 1958.

DITCHES OR PIPES?

The idea of re-organizing the fields on a farm and filling in the ditches is becoming more and more popular, especially as the work may be eligible for grant under the Farm Improvement Scheme. There is a lot to be said in favour of the idea; the holding becomes much easier to work, there are fewer ditches to be kept clean and looked after, and there is far less cover for vermin and pests. But there is another side to the picture.

Apparent useless hedges may be the boundary between two types of soil and the adjoining ditch dug to intercept water flowing from the upper layer. In such cases there is much to be said in favour of keeping the ditch. Differing types of soil require different treatments, and even if the two fields are made one they may well have to be cultivated and cropped as separate units.

Another point: there is a limit to the amount of water that a pipe can carry. A normal hedge-side ditch 3½ feet deep and 12–15 inches across the bottom can deal with something in the region of five times as much water as a 15-inch diameter pipe. Even if the ditch overflows the flooding is limited, except in very flat country, to a relatively small area on either side, and quickly drains away once the flood has passed. Things are totally different with a pipe. Once the maximum capacity has been reached, the extra water builds up in the system of open ditches (if one exists) at the top end of the pipe until it overflows the banks and runs down the field as a miniature river, taking the surface soil and crops with it. An expensive way of avoiding ditching maintenance!

Under exceptionally heavy rain, ditches and hedges running across the general slope of the land may intercept water running over the surface before it can do much damage. In their absence, severe surface erosion or gullying could occur.

Gradual blocking of pipes by tree roots or silt may not become apparent until wet places appear on the surface of the field or the crop begins to fail. Even then the wet patch may appear some distance away from the drain and in such a position that it is not easily connected with trouble in the drain.

Many ditches and hedges are, of course, serving no purpose which could not equally well be fulfilled by a pipe, and these could with all-round advantage, be removed. But it is desirable to "look before you leap" and take the precaution of getting technical advice first.

SILVER CHALLENGE BOWLS FOR BACON PIGS

Regular supplies of well-graded pigs are being encouraged by the generosity of the British Feeding-Meals Co. (Seemeel). The Company has provided twenty-one silver challenge bowls, to be awarded annually to those pig farmers securing the highest percentage regularly for their bacon carcasses (averaged over the four quarters of the year) and top grading. How or on what foods the pigs are fed in no way affects the eligibility of producers to win an award. No entry forms are required—only the consignment of good pigs in sufficient numbers to bacon factories regularly.

One silver challenge bowl will go to each of eighteen areas of the F.M.C. in England and Wales, and three to those dealing direct with (a) the Letchworth Bacon Factory, (b) Venners of Reading, and (c) the Yorkshire Farmers' Bacon Factory. Judging for the year ended 31st October 1958 has already started.

Full particulars can be obtained from the British Feeding-Meals Co. Ltd., Carpenters Road, Stratford, London, E.15.

IN BRIEF

INTERNATIONAL PREPACKING EXHIBITION

Some eight thousand people, mostly growers and distributors and including many Continental visitors, attended the first International Exhibition on prepacking fresh fruit and vegetables held in the New Hall of the Royal Horticultural Society in London early in October.

The aim of the Exhibition was to show prepacking from farm to consumer and to demonstrate the machinery, methods and materials available to those interested in this new development in the field of horticultural marketing. Although there were some Continental exhibitors, the great majority were British. Of all horticultural commodities, potatoes top the list, and it was not surprising therefore, that the Exhibition contained several of the latest machines (automatic and semi-automatic) for cleaning and bagging potatoes. A wide display of wrapping materials and types of containers could be seen—transparent and semi-transparent films and packs, board, paper and plastic containers, nets and so on. Some excellent examples of prepacked produce exhibited by grower and wholesaler packers showed how attractively produce can now be presented. It was clear that many visitors found much that was of more than passing interest to them.

Mr. F. J. Erroll, Parliamentary Secretary to the Board of Trade, opening the Exhibition, said that manufacture had always been at the service of agriculture. It had produced the machines to help the farmer plough, sow and harvest; that help was now being extended into the field of marketing. The Exhibition amply demonstrated the truth of these words; and it showed how the horticultural industry is rising to meet modern consumers' needs.

The Produce Prepackaging Development Association organized the Exhibition, which was sponsored by the European Productivity Agency of O.E.E.C. and arranged by the Ministry of Africulture.

A special article on prepacking, by Mr. G. H. Stansfield, appears on pp. 384–7 of this issue.

EFFECT ON YIELD OF UNDERSOWING WINTER CRAIN

Does undersowing with clover or a seeds mixture affect the yield of grain crops and, if so, how? This is a question frequently asked. An experiment at Woburn with winter cereals gives some direct evidence on the subject.

This experiment consisted of a five-year rotation of potatoes (to some plots of which farmyard manure was applied at the rate of 15 tons per acre) wheat or rye which was either undersown with a seeds mixture or grown alone, followed in the former case by a hay crop and in the latter by sugar beet. It is thus possible to compare the yield for a series of years of plots otherwise completely indentical in treatment, except that four years before the cereal plot had grown sugar beet and the other hay. (This exception should make little difference to the grain crop which would be grown on these plots four years later.)

We have a record of sixteeen crops of wheat with and without undersowing (1939-48) and sixteen crops where rye was grown (1949-56). The mean figures (cwt./acre) for each of the crops in question were:

Yield of Winter Wheat (1939–48)		*Yield of Winter Rye (1949–56)*	
(a) *With farmyard manure*		(a) *With farmyard manure*	
Not undersown ...	12·5	Not undersown ...	32·5
Undersown	12·4	Undersown	32·7
(b) *Without farmyard manure*		(b) *Without farmyard manure*	
Not undersown ...	11·7	Not undersown ...	31·2
Undersown	11·7	Undersown	31·6

In all cases the grain crop had, according to present-day standards, an insufficient dressing of nitrogen; usually only 1 cwt. per acre sulphate of ammonia

was given. It is clear, however, that under the circumstances there is little difference in the crop of grain reaped due to undersowing with the clover-seeds mixture. *Harold H. Mann*

ANIMALS AND ARSENIC

Mr. W. Griffith Jones, writing in a recent issue of *The Veterinary Record*, expresses the opinion that cases of arsenical poisoning are on the increase—due to the more widespread use of arsenical sprays for potato haulm destruction. "Arsenic," he says, "is again becoming a strong challenger to lead as the foremost toxicological hazard to livestock. Out of twenty-four animals encountered with arsenical poisoning, all but two have been a sequel to the use of these potato sprays". Eighteen of these cases were cattle, and four were dogs. Such cases, of course, are seasonal, occurring chiefly in September.

In one case quoted by the writer, a potato field was sprayed with a mixture of sodium and potassium arsenite, and two hours later twelve store cattle got into the field through a broken fence. It is estimated that they were there for one hour. Six milking cows also grazed sprayed nettles in the hedgerow surrounding the potato field. Professional advice was sought thirty-six hours later when two animals were found dead, one prostrate, two staggering, and the rest exhibiting symptoms of gastro-enteritis to a varying degree.

After a latent period, the onset of symptoms was rapid. Within four hours of the first visit the prostrate and staggering animals were dead; in a further forty-eight hours two more had died.

Another case was of four gun dogs which, circumstantial evidence suggested, were poisoned as a result of skin contamination due to their crossing a field of potatoes five days after spraying.

NATIONAL LAMBING COMPETITIONS

For the second year running, the Cotswolds have captured the "Farmer and Stock-Breeder" supreme championship in the National Lambing Competitions. This year's winner was the Hon. E. R. H. Wills of Farmington, Northleach, Glos. His flock of 416 Half-Bred ewes reared 814 lambs—a percentage of 195·7. Thirty-four of the ewes reared triplets. The highest lambing percentage, however, was secured by Mr. F. W. Darling's 37 cross-bred Mashams, which reared 77 lambs (208·1 per cent), so winning for him the Wool Marketing Board's Trophy. He farms at Billingham, Co. Durham.

The J. F. H. Thomas Trophy, awarded for the best performance among specified lowland breeds, went to Mr. T. E. Bason of Montgomery (90 ewes reared 182 lambs). The A. N. Bocock Trophy for the best of the hill flocks was won by Mr. Ian Cullens of Clackmannanshire (506 Scottish Blackface reared 517 lambs).

These and other awards were presented by the Minister of Agriculture at a dinner in London on 14th October.

THE GOLDEN PLOUGH

The World Ploughing Championship, which was held on 3rd-4th October at Hohenheim, near Stuttgart, was won by Mr. T. Leslie Gardener of Herefordshire. The famous Esso Golden Plough trophy was presented by the German Minister of Food before an audience of 2,000 people, assembled in the new Stuttgart Liederhalle.

Britain also won the second and third places, respectively by Mr. William J. MacMillan of Dundonald, Belfast, and Mr. John Dixon, the oldest competitor (aged 50), of Billingham, Co. Durham. Sixteen countries competed.

Book Reviews

Farming: Learning and Earning. JAMES GUNSTON. Odhams. 18*s*.

Mr. Gunston rightly emphasizes that in farming, though you may earn money while you are learning, it is equally possible to lose it! This is an eventuality which every beginner should anticipate in his first years and should plan to meet.

The author writes with authority. After twenty years as farm manager to the Earl of Leicester at Holkham, he ventured on a smallholding of his own, an enterprise which, specializing in poultry and market gardening, has proved very successful. We are also familiar with his voice as a broadcaster on agricultural matters and with his farming books, of which he has written a dozen. To the novice about to tread the hazardous path of compelling a living from the soil, Mr. Gunston offers selections from the accumulated wealth of a lifetime of practical work on the land, backed by sound technical knowledge.

The first of the three main sections into which the book is divided sets out explicitly to be a "Guide for Beginners". It gives valuable information about agricultural education, becoming a farm pupil, choosing a farm and the general management of soil, crops and livestock. The straightforward description of how Mr. Gunston left school at thirteen and spent ten years as a farm worker before improving his position will hearten all who feel they have educational handicaps to overcome. In four years, by intelligent initiative and hard work, he gained two National Diplomas and various college diplomas and certificates. These launched him speedily into a post involving the management of a 2,000-acre farm. In view of the increasing emphasis on agricultural education, his chapter on this subject is remarkably sound and helpful.

That part of the book which he describes as "Alternatives to Farming" is obviously near to the author's heart and is devoted to smallholdings and market gardens. He is so much at home here that we could wish these chapters were longer.

Lastly, we have a section on technicalities, which constitute almost a miniature encyclopaedia on soil, plant life, livestock and manures.

Throughout the book Mr. Gunston concentrates on fundamentals. In many places this results in the good, sound, practical advice which we look for from a man of his experience, but in others he uses so much space in restating basic facts that he has little room left for the more detailed information which is likely to be found more helpful. I can, however, recommend it as a most helpful contribution to anyone contemplating farming.

R.W.

Botany: An Introduction to Plant Science. (2nd Edition). WILFRED W. ROBBINS, T. ELLIOT WEIER and C. RALPH STOCKING. Chapman and Hall (London), John Wiley (New York). 56*s*.

First published in 1950, this text-book has enjoyed a great measure of popularity in American colleges, but has made a very limited impact in England. With the death of the senior author, the preparation of a new edition has devolved on his two collaborators and, let it be said at the outset, they have succeeded admirably in producing an attractive volume in which the matter is presented in a clear and imaginative way. The sequence of the book follows the normal pattern, with three preliminary discussion chapters forming an interesting introduction to the more detailed survey of the plant kingdom.

While the fundamentals of the subject are not affected by the type of plants chosen for study, American text-books commonly select species which are difficult to obtain here. This criticism cannot be made of the well-produced and adequately illustrated volume under review which, apart from occasional and inoffensive spelling variants, does not have a strong American bias and can be recommended for use in this country.

G.T.

Japan's Economic Recovery. G. C. ALLEN. Oxford University Press. 25*s*.

Japan's Economic Recovery is published under the auspices of the Royal Institute of International Affairs, and is an authoritative account of a remarkable feat of recovery from war-time devastation. The author, who is Professor of Political Economy in the University of London, has already written other books on the economy of the Far East, and is clearly a master of his subject. The present book is based on first-hand knowledge gained during a visit to Japan in 1954, as well as on information from many published sources which are indicated in footnotes and listed in a bibliography at the end of the book. There is also a statistical appendix that presents many useful facts about population, employment, industry, foreign trade, and other aspects of the economy before and since the war.

The book begins with an account of Japan's economic development during the 1930s—a forced development making "lavish provision for the militarists' appetite"—and this chapter provides a valuable basis of comparison for the war-time and post-war changes. By the end of the war, after devastating air raids, Japan was a country laid waste; the people were living at a bare level of subsistence, and industry had to be rebuilt.

The early years of the reconstruction were accomplished under the direction of the occupying powers, which were predominantly American. At first the emphasis was more on social reform than on economic recovery but, as this policy proved very expensive in terms of American aid, progressively more encouragement was given to industry and to monetary stabilization. After full sovereignty was restored to Japan in 1952, some of the earlier social changes were halted or reversed, but the economy of the country went on developing rapidly. The index of industrial production continued to rise, smaller firms began to share in the prosperity, and the export trade went ahead. It is noteworthy, however, that since the war exports have not developed to the same extent as has internal production. Japan is now much more self-contained than before the war, despite her larger population, and the ratio between her international trade and her national income is, today, one of the lowest in the world.

There are chapters describing how these changes were brought about, in monetary affairs, in the textile and engineering industries, in iron and steel, fuel and power, and miscellaneous trades. Changes in agriculture are also described fully; outstanding was the post-war land reform, by means of which the proportion of land farmed by tenants was reduced from the pre-war 46 per cent of the cultivated area to only 8 per cent in 1952. Food production was increased, this being done (according to the author) mainly by varietal improvements and by the heavy application of fertilizers. The increase in food production was almost sufficient to feed the growing population, which was 69 million in 1935, 83 million in 1950, and 90 million in 1956. The population is expected to rise to at least 96 million by 1965 and to be over 100 million by 1970, after which it may be stabilized. In consequence, many problems still remain, and some of them are discussed in the last chapter, "Achievements and Prospects".

H.L.R.

Magnesium: the Fifth Major Plant Nutrient. A. JACOB. Staples Press. 40*s*.

First published in Germany in 1955, this book is the first comprehensive account dealing with magnesium as a plant nutrient. The first two chapters, both short, deal with some of the chemical properties of magnesium and the mineral composition of a wide range of crops. It is shown that the average magnesium content of plants is less than that of calcium and potassium but approaches that of phosphorus; for this reason, magnesium must be regarded as a major nutrient. Magnesium deficiency symptoms are described and illustrated, but the colour plates are not particularly good. Ion antagonism between Ca/Mg, K/Mg, H/Mg and NH_4/Mg is reviewed but there is little discussion on the mechanisms involved. The older work on the function of magnesium in living processes is dealt with adequately but the author does not do justice to more recent work on the role of magnesium in enzyme reactions.

The second half of the book is concerned with the magnesium economy of the soil (here it is shown that the losses by plant uptake and by leaching are greater than the additions in farmyard

manure and fertilizers); chemical and biological methods for estimating available magnesium; distribution in world soils; fertilizer experiments; and the composition and use of magnesium fertilizers.

The author rightly calls attention to the increasing incidence of magnesium deficiency in crops and advocates greater use of magnesium fertilizers.

The book contains a great deal of factual information which should be very useful to agronomists.

C.B.

Wild Venture. KENNETH RICHMOND. Geoffrey Bles. 21*s.*

Wild Venture gives a first-hand account of many of the larger Scottish birds, such as hawks, grouse, geese and gannets and of a few of the smaller ones—storm petrels and red-necked phalaropes, for example. It is illustrated by twenty-five photographs, some of exceptional interest and merit.

The author writes with a facile pen in a racy style which, for all its gloss, fails to conceal the alert mind and practised eye of a field naturalist very conversant with the birds he describes—and loves. He makes no secret of the fact that his first love is for the hawks: golden eagles at the eyrie, hen harriers in the high glens, captive buzzards, goshawks and Iceland falcons. Indeed the two chapters on hen harriers are perhaps the pick of the book; they contain a wealth of authentic observations, hard won while following up the family histories of two generations of these splendid birds.

Blackcocks at their lek, ptarmigan on their lone summits, Solway geese on merse and mudflat, divers, short-eared owls, gannets on Ailsa Craig, all are summoned to beguile the reader by the author's persuasive and nostalgic pen. Here he is at his best—by mountain and loch side, tramping the moors in wind and rain, watchful and competent—letting off steam in apt soliloquy, for he is a man of unbounded energy. But not one to suffer fools gladly. Small wonder, perhaps, that he sits at home a little testily, tilting at tenets held sincerely by other naturalists —some, maybe, of wider vision and experience than himself. However, sauce for the goose is sauce for the gander: if the alternative suggestions he advances—on vagrants, or on drift migration, for example—seem to be less convincing than the theories they supplant, he must not mind if we rate his book more highly for its outdoor flavour than for its armchair criticism. He has given us a book for which we are all profoundly grateful.

E.A.R.E.

Labour Management on the Farm. O.E.E.C., Paris. H.M. Stationery Office, London. 12*s.* (12*s.* 7*d.* by post).

This report summarizes the proceedings of an international conference held in Holland in 1956 under the auspices of the O.E.E.C. Its title, however, misleads. The conference was concerned with planning and machinery as well as labour. Indeed, it made a valiant but unsuccessful attempt to reduce to order that amalgam of hints, tips and principles collected from more precise disciplines which we vaguely call "farm work simplification". This confusion in purpose has bred confusion in argument, which has been increased by the loose definition and use of the phrase "work study", a subject which has in any case developed greatly since this publication was prepared. By contemporary British standards, the technical section on method study is weak and incomplete, and the section on work measurement too grotesquely oversimplified to be acceptable. On no account should this chapter be regarded as a guide to modern practice and the report's recommendations on the use of work study in advisory work should be discounted accordingly.

The report, however, contains some interesting and valuable papers on a variety of topics. A Dutchman describes the place of the farm diary in advisory work in his country; a Swede, the use of work study techniques in establishing piecework rates; a Frenchman, the planning of farmsteads to reduce labour; and an Englishman, the use of research in providing data for the design of machinery. Perhaps the most striking contribution is from Professor Lehmann of the Max Planck Institute, who analyses the physical properties and needs of that basic farm-machine, man, and the means of making the best use of his energies. It is fascinating to read the evidence he produces on such matters as rest-pauses, the energy-requirements needed in driving tractors under different conditions, and the effect on health of the vibrations

reaching the driver through different kinds of tractor-seat. It is saddening to reflect how little we have studied so important and obvious a subject.

The report ends with chapters on preparing an advisory programme in labour management and the training of those who administer it. The lengthy list of relevant publications has now inevitably been superseded by more recent bibliographies, notably that issued by the British Productivity Council on behalf of The Agricultural Work Study Group.

N.H.

Pig Carcass Evaluation. G. HARRINGTON. Commonwealth Agricultural Bureaux. 15*s.*

In a concise but readable manner, this book reviews the literature on the subject "What is carcass quality and how can it be measured?" The first chapter deals with the estimation of carcass composition, and particularly the correlation between simple methods and complete dissections or chemical analyses. It appears that the best simple technique for determining fat percentage is by measurement of specific gravity (which involves weighing in water and in air); but measurement of back-fat thickness is a good second.

The next chapter discusses what information on carcass composition can be obtained from the live pig. The most promising line here is the use of X-ray and ultrasonic measurements of back-fat thickness. Experiments have shown the virtual impossibility of estimating the carcass characteristics of a bacon pig by looking at or measuring the live animal.

The section on the methods of estimating fat firmness and quality of lean meat (tenderness, taste, juiciness and colour) draws considerably on the results of research on beef. The difficulties of arranging satisfactory objective methods or tests are stressed. Carcass weight and conformation and how they should be measured, together with the application of the methods described to the grading of commercial carcasses, carcass competitions, and progeny-testing stations are all covered.

The final chapter adds further discussion on the determination of fatness, carcass measurements and visual assessments, and on consumer preferences. Throughout the book the presentation is critical, and the reader is given every help in choosing between the methods described.

No one concerned in any way with pig carcasses can afford to be without this work, which is also of interest to workers in other branches of meat production, since some 40 per cent of the 373 references concern meat in general, or animals other than the pig.

I.L.M.

The Right Way to Keep Hens, Ducks, Geese and Turkeys. (Right Way Books). ROBERT H. HOLMES. Elliot. 7*s.* 6*d.*

In *The Right Way to Keep Hens, Ducks, Geese and Turkeys,* Mr. Holmes breaks away from what we are now led to believe are orthodox "up-to-date" methods.

His writing is refreshingly different. It is particularly useful to the beginner and those who have started poultry farming since the days of feedingstuffs rationing, because it induces them to think for themselves, rather than be tied down to any hard and fast rules which may or may not be economically sound. It also makes the more experienced farmer stop to think.

The book should not be expected to provide a full working knowledge for a beginner, but rather an introduction to the fuller study needed for success in various aspects of poultry farming. On the other hand, although his intentions are to give first principles, Mr. Holmes has contrived to put a great deal into his work which might well be missed out of a book claiming to impart greater technical knowledge.

In his chapter on incubation I think the author should have paid greater attention to the description of a hot air incubator, for the simple reason that success in incubation depends not only on attention to day-to-day routine, but also on a knowledge of the type of incubator employed, the housing it requires and on air movement—a fact that cannot be too strongly stressed.

In spite of one or two technical points on which I am not in complete agreement with Mr. Holmes, I think his book will prove of interest to all and should serve to widen our views. The arguments which he has put forward in defence of the progress of the British poultry farmer will be much appreciated by the older hands.

He gives sound advice on market trends, and I hope that his timely warning about over-production in the broiler industry will be heeded by the younger producers.

J.T.W.

Applications of Atomic Science in Agriculture and Food. O.E.E.C., Paris. H.M. Stationery Office, London. 6*s.* 6*d.* (7*s.* by post).

A mission sponsored by the European Productivity Agency, and composed of experts in various fields related to agriculture, visited the U.S.A. in the spring of 1957 to study applications of atomic science. Most of its time was spent in visiting research institutions; the report under review is mainly concerned with this part of the visit.

The book briefly surveys uses of atomic science in the U.S.A., and sets out possible developments in O.E.E.C. countries.

The greater part of the book comprises the scientific report which begins with a description of the general principles of radio-activity and a brief summary of some methods of measurement. It is difficult to see the value of this section, since the information in it will be well known to the specialist, but inadequate for the person not familiar with this type of work. Experimental work using radioactive tracers in plant and soil research and in animal studies is outlined, together with studies of radiation effects and the use of radiation in food preservation. This last section gives greater detail, and is probably the most valuable part of the report. A note of warning is sounded concerning the early hopes of great progress which have not been realized; and it is pointed out that much work is still needed, particularly on unpleasant odours and tastes resulting from irradiation.

It is clear that the participants in the mission had an extensive programme and, purely as a report on the mission, this book fulfils its purpose. It must be pointed out that it does not purport to be a comprehensive manual on its subject, but it may be useful in giving an indication of the type of work which may benefit as a result of atomic science.

In general, the book is reasonably free from misprints, but a rather striking one results from the use of "m" (milli-) instead of "M" (Mega-) in a sentence which should read "a dose of 1 Mrep raises the temperature of water approx. 2°C".

R.P.M.

Capital and Credit in Agriculture: International Journal of Agrarian Affairs, Vol. II, No. 4, January 1958. Oxford University Press. 5*s.*

The series of articles on agricultural capital, which began in the last number of the *International Journal of Agrarian Affairs* is continued in this issue, but it covers a far wider field, both geographically and culturally. It ranges from communist Yugoslavia, where the very word "capital" is anathema and the economists have invented the term "necessary means", to Australia, where the average farm income on the larger sheep runs is £11,163 per farm!

It is these violent contrasts which make these articles particularly interesting. There are physical contrasts, between the vast farms of the Australian outback and the small fragmented holdings of Japan, where the average farm covers one hectare; and, largely arising out of these contrasts, there are differing attitudes towards capital and credit. For instance, the authors of the articles on Australia and Western Germany concentrate upon the need to stimulate the generation of capital from within the industry, while the other authors look for sources of capital outside it, such as state intervention, co-operatives and special credit institutions.

Closely allied to the physical size of holdings is availability of labour. "In agriculture the fundamental task of capital is to take the place of excess of manpower," says Vittorio Ciarrocca of Italy in a stimulating article, which is by far the most readable in the symposium. This is the key to the problem, and explains the world of difference between the attitude of the Yugoslav economist with his "necessary means" and his Australian, or for that matter British, counterpart.

But there are similarities as well as contrasts, and underlying all the articles is a unity of purpose—a common sense of urgency. For, in the long run, it is the degree of capital formation in agriculture which determines the ultimate prosperity of the industry. That is why this series of articles is so well worth reading.

B.E.C.

Planning the Farm to Save Labour. (University of Cambridge, School of Agriculture, Farm Economics Branch Report No. 47.) F. G. STURROCK and G. H. BRAYSHAW. 4*s.* 6*d.*

The British farmer spends half his time on livestock; but nearly all of the farmsteads in which he does most of this work are, for various reasons, inefficient for the purpose. Hence there is a great waste of skilled labour, much of which goes on such purely mechanical drudgery as the basic farmstead chore of moving something from one place to another. Such is the background to *Planning the Farm to Save Labour*, which summarizes the findings of prolonged investigations into the methods used, and the labour required, to manage the livestock housed in the farmstead; the effects of these methods on the design and relationship of the buildings which serve them; and the principles of planning methods and buildings to save labour.

After a general statement of the problem, the report systematically works its way through milking techniques; cowhouses and parlours, including a comparison of the labour-requirements of the cowhouse system with those of certain types of parlour system; the design of yards, with suggestions influenced by developments in America; and methods of housing young stock. The enterprises differ, but the approach is the same—jobs and routines are studied, and the principles of good design and planning to secure the most efficient use of labour are deduced from this analysis. Everybody interested in farm buildings should read this report, and read it with care, for anyone tempted to turn too early to the sections headed "Conclusion" or "Summary" will miss much. The facts, arguments and order of thought used in the preparation of the designs are as important as the designs themselves.

Certain "standards" are also given, the first of their kind to be published. These are average times—unfortunately the number of recordings taken to obtain them is not given—required for certain jobs and they are intended as yardsticks by which farmers or advisory officers can assess the efficiency of existing livestock enterprises or the labour requirements of proposed ones. At first sight, the value of such average-performance data in types of work peculiarly haunted by variables seems uncertain, for they can have only a very general application to any particular enterprise on any particular farm, but we must wait and see how they work in practice. Incidentally, these "standards" should not be confused with the far more precise "standard times" or "reference data" of work study, which are, of course, obtained by a radically different system of measurement and adjustment.

N.H.

Books Received

Principles of Horticulture. E. L. Denison. Macmillan. 48*s.* 6*d.*

The Grafter's Handbook. R. J. Garner. Faber and Faber. 25*s.*

Economics of Agriculture. Anne Martin. Routledge and Kegan Paul. 21*s.*

Encyclopaedia of Chrysanthemums. Monica Bennett. C. Arthur Pearson. 21*s.*

The State of British Agriculture, 1957–8. K. E. Hunt and K. R. Clark. Agricultural Economics Research Institute, University of Oxford. 10*s.*

The Advancement of Science. Volume XV, No. 58, September 1958. The British Association for the Advancement of Science. 7*s.* 6*d.*